

***2007***  
***SOUTH CAROLINA***  
***SCHOOL BUS***  
***SPECIFICATIONS***

***General***  
***Specifications***

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### ***General Specifications***

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**GENERAL INFORMATION**

These specifications shall cover the minimum requirements for Type C and Type D school buses constructed for sale to the South Carolina Department of Education, Transportation; (herein referred to as SCDOE,T) and other state supported entities providing student transportation services.

It is the intent of these specifications to provide vehicles allowing the safest operating conditions available, the greatest ease of maintenance, and the lowest possible life cycle cost.

In all cases, the materials and/or equipment used in the construction of these vehicles shall meet or exceed the requirements of these specifications. The buses shall consist of the specific items listed and such other items or components that are considered industry standard in a complete school bus. Each unit shall be constructed with identical equipment and features for like capacity units purchased under a single order.

All models offered for sale must be new and of a model in current production or an update of an existing model. All buses shall meet the requirements of the Federal Motor Vehicle Safety Standards (FMVSS) for School Bus Construction. All buses shall meet the requirements of the 2005 National School Transportation Specifications and Procedures unless otherwise stated herein. The quality of materials and workmanship shall result in completed school buses being delivered ready for operation ("Ready to Use") for the intended application. "Ready To Use" shall be defined as meeting all applicable specifications, with all equipment functioning properly and without substantive defects (as determined by SCDOE,T).

The SCDOE,T does not guarantee the purchase of any minimum quantity of buses as a result of establishing this contract.

**EXCEPTIONS**

By submission of signed bid, vendor certifies that the equipment it proposes to furnish complies with all specifications listed herein. Substitutions for specified items must be approved by the SCDOE,T in writing, prior to submission of bid. It is the responsibility of the bidder to provide adequate information for evaluating the acceptability of any and all items they wish to offer as substitutes.

Any vendor wishing to request approval for substitutions or obtain clarification of language used herein must submit their requests using the enclosed forms (see Appendix) and accompanied by all necessary information through the Materials Management Office, South Carolina Budget and Control Board. The Materials Management Office must receive all requests in accordance with the timelines as stated in the bid solicitation.

**INSPECTIONS**

The successful vendor shall provide a pilot model designed and built to meet these specifications for each type and capacity of bus that is purchased under this contract. These pilot models shall be made available for inspection by representative(s) of the SCDOE,T to ensure compliance with the attached specifications.

In addition to the completed units, partially completed bodies and chassis shall be made available showing attachment of frame members and structural components. At least one completed unit of each type shall be made available for road testing to insure satisfactory performance.

During the inspection, all access doors/panels shall be opened and in some cases removal of various components may be required. It shall be the responsibility of the successful vendor to provide adequate information and assistance in performing the pilot inspections. These inspections shall be performed and all necessary changes approved prior to placing remaining units into production.

The successful vendor shall furnish round trip transportation (travel, meals and lodging) to its factories/assembly plants for up to four (4) representatives of the SCDOE,T to perform the pilot inspections and any subsequent inspections (up to 6 trips for 2 representatives) that are needed due to problems that arise during the time of production. Travel, meals and accommodations shall not exceed standard rates established by South Carolina State travel policies and regulations.

**PUBLICATIONS/SOFTWARE**

The successful vendor shall be required to furnish one set per bus purchased (maximum of 60 sets) of all pertinent parts books, service manuals, wiring diagrams, etceteras for the units ordered. All information shall be specific for the parts and components used in the construction of these buses. This information may be provided electronically by CD, DVD, or by internet web-access to the manufacturer's website. If web-access is the method chosen; this must be provided at no cost for the life of the bus.

Additionally, the vendor shall furnish one set per every ten buses purchased (maximum of 60) complete diagnostic software (Windows XP compatible) with perpetual license, that is necessary to diagnose/program multiplex wiring systems, access engine history, access engine operating parameters, and to provide full engine diagnostic and reprogramming capabilities, transmissions, chassis and ABS components. There shall be no licensing fees. If the Noregon DLA-USB data link adapter (CAN/J1939, J1708/J1587 w/ 6 & 9 Pin Deutsch Y-Cable) will not provide the required vehicle/computer interface; then any necessary adapters/connectors shall be provided.

**SERVICE**

A pre-delivery service shall be performed on each bus prior to delivery. This service shall insure that all fluid levels and tire pressures are at proper levels and that all

components on the buses are fully operational and properly adjusted. Documentation shall be provided to the SCDOE,T on each vehicle serviced noting the repairs and/or adjustments necessary. Other notations shall at a minimum include total miles driven during road test (minimum of 10 miles), transmission shift points at full throttle, coolant freeze levels, coolant inhibitor levels, front axle alignment and tire balance. The engine and transmission manufacturers shall insure that their products are properly installed and adjusted for optimum performance.

**DELIVERY**

TYPE C BUSES - Bus delivery shall begin within one hundred eighty (180) days from the date of issuance of the completed purchase order.

TYPE D BUSES - Bus delivery shall begin within one hundred fifty (150) days from the date of issuance of the completed purchase order.

The times listed above shall include any time necessary for completion and approval of the "Pilot Model(s)". After the initial timeframe as indicated above, the vendor shall deliver a minimum of ten percent (10%) of total order or a total of forty (40) units, whichever is greater during each consecutive thirty (30) day period. Failure to adhere to the delivery schedule will subject the vendor to Liquidated Damages.

Based on orders placed, the percentages of the various capacities of buses to be delivered each thirty (30) day period will be agreed upon by the manufacturer and the SCDOE,T.

Contractor is required to assume full responsibility for the delivery of buses to locations as specified by the SCDOE,T and shall save the state harmless against fire, public liability, and property damage until delivery is complete at the specified site. Delivery shall be made during normal school bus shop operating hours (7:00 AM – 4:00 PM) and workweek (Monday – Friday). Deliveries will not be accepted on state holidays.

See enclosed listing (Appendix) indicating delivery destination points. Exact quantities to be delivered to each point will be provided at the time orders are placed. Upon delivery of each bus, a representative of the SCDOE,T shall be required to sign a Delivery Manifest. The signing of the manifest shall complete the delivery of the bus and shall verify vehicle identification number (VIN), unit number and any visible damage.

**LIQUIDATED DAMAGES**

Liquidated damages in the amount of fifty dollars (\$50) per workday, per bus, shall be assessed for failure to meet the delivery schedule. The damage period shall begin on the first workday following the thirty day period. The damage amount will be deducted from the payment to the vendor for those particular buses. Vendors will not be responsible for liquidated damages in the event that the SCDOE,T requests later delivery dates.

By submitting a bid, vendors agree that these damages are a reasonable estimation of damages and do not constitute a penalty.

### **TITLE/TAG REGISTRATION FORMS**

The manufacturer shall provide "A Certificate of Origin" for a vehicle and an original South Carolina Department of Revenue Form-400, typed, completed, and notarized for each vehicle purchased. The address on these forms shall read, "South Carolina Department of Education, 1429 Senate Street, Columbia, South Carolina 29201".

These forms along with a copy of the Delivery Manifest shall be attached to the invoice for each VIN and unit number listed. None of these forms shall be delivered in the bus but, will be mailed or hand delivered to:

Office of Transportation  
Room 209-C  
1429 Senate Street  
Columbia, South Carolina 29201

### **TRAINING AND SUPPORT**

The successful vendor shall be responsible for providing orientation training (minimum of 5 hours per bus purchased) for state supported school bus maintenance personnel. This training will begin on or about the date of the first deliveries and will continue across the state until all shops receiving buses under this contract have been covered.

Training shall be provided at various sites as designated by the SCDOE,T and shall be provided at no charge. In no event shall this orientation training extend beyond the first three (3) months of deliveries.

Additional training will be provided on specific components as deemed necessary by mutual agreement between the SCDOE,T and the successful vendor. This training will be identified at a later date and shall be furnished at no additional cost.

The successful vendor shall have on staff a service representative assigned to South Carolina to respond immediately to any problems that may arise during the delivery and in-service of the buses and for a time period of at least one year from the date of final deliveries. This service shall be provided at no charge to the SCDOE,T.

### **WARRANTY**

Bidders shall be required to furnish with their bids a warranty (parts and labor) covering all materials and workmanship used in the construction of vehicles provided under this contract; excluding normal service and maintenance items (fluids, filters, tires, bulbs). Written warranties MUST be included with bid package.

Warranty coverage shall be 60 months/150,000 miles whichever occurs first for complete power train, computer systems, electronic controls, electronic devices/components, body structure, and paint. All other items shall be warranted

for a minimum of twenty four (24) months or manufacturer's standard warranty, whichever is greater, unless otherwise specified herein.

Towing of buses shall be required when continued operation of the bus would result in an unsafe operating condition or would cause additional damage. SCDOE,T shall not be responsible for towing charges resulting from the failure of a warranted component.

Components carrying extended warranties or warranties that are supported in part or in whole by a party other than the bidder shall require written certification. This certification must be attached to the bid and shall be in the form of a letter, on company letterhead, clearly delineating the portion of warranty to be covered and signed by appropriate personnel. It shall be understood that certification by component manufacturers in no way decreases the bidders responsibility for maintaining the warranty periods as specified herein.

The SCDOE,T facilities and/or other State funded school bus maintenance facilities shall be established as warranty repair centers for all components included in the manufacturing of these buses. Training that is necessary to perform warranty repair work shall be provided by the manufacturer. Any major repairs will be the responsibility of the manufacturer.

1. IN-SERVICE DATES - Warranty shall become effective on the In-Service Date as established by the SCDOE,T. This shall be the date on which the bus is placed into actual service by the SCDOE,T.
2. WARRANTY CLAIMS - The successful vendor shall furnish the SCDOE,T at no charge all necessary guidebooks and flat rate times necessary for submitting warranty claims. All warranty claims submitted by the SCDOE,T shall be submitted electronically or if hard copy in spreadsheet form, to the manufacturer. Individual records relating to warranty claims shall be maintained at the various school bus maintenance facilities.

Response to claims shall be made in a timely manner by payment or with information necessary for resubmission of claim. A labor rate of fifty five dollars (\$55.00) per hour shall be used in computing labor cost. All reimbursements for warranty work shall be submitted by check made payable to:

South Carolina Department of Education  
Office of Transportation  
1429 Senate Street  
Rutledge Building, Room 209 C  
Columbia, South Carolina 29201

3. WARRANTY PARTS - Failures covered by Warranty shall not require any purchases or encumbrances of other costs by the SCDOE,T. The cost associated with replacement parts shall be borne by the Manufacturer.

The procedure for handling warranty claims on miscellaneous items shall be as outlined below.

- a) When an item fails while under warranty, the Engineering Associate will electronically notify the Manufacturer/Dealer for replacement part(s).
- b) Replacement part(s) will be shipped directly to the identified shop within twenty four (24) hours at no charge to the shop.
- c) If the failed part is required for evaluation, it will be shipped freight collect to the Manufacturer/Dealer or held for pick-up. No parts shall be held in excess of sixty (60) days.
- d) Labor will be billed directly to the Manufacturer at the rate specified in this bid.

### **NON-COMPLIANCE AND COMPONENT FAILURE**

The SCDOE,T reserves the right, should an error be discovered or conclusive proof of defective work or materials used by or on the part of the contractor be discovered after acceptance and payment has been made on any bus, to have the contractor, at his expense, make good such defects and on refusal to do so, to claim and recover by process of law such sums as may be sufficient to correct the error or make good the defects in work and materials.

Any structural repairs, recalls, or campaigns involving greater than twenty percent (20%) of a single year model shall be handled by the manufacturer/dealer unless the SCDOE,T agrees to complete the repairs.

The SCDOE,T reserves the right to require total replacement of all parts if the failure rate for that particular item exceeds twenty percent (20%) for the year model purchased.

This section in no way limits SCDOE,T's remedies at law or equity. SCDOE,T reserves all legal rights at law and equity.



***2007***

***Type C***

***Specifications***

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***Type C***

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**AIR CLEANER**

Each engine shall be equipped with a heavy-duty, dry type, replaceable cartridge air cleaner. The air cleaner shall be mounted so as to allow for servicing and/or replacing the element without removing or loosening the housing. A constant reading, re-settable air restriction gauge shall be permanently mounted in the system.

**AISLE**

There shall be a minimum of twelve inches (12") of unobstructed aisle to the emergency doors.

**ALARMS**

1. BACK-UP ALARM - An audible back-up alarm shall be mounted within three feet (3') of the rear of the bus and between the frame rails. Alarm shall face rearward, shall be protected from debris and shall be capable of producing at least one hundred twelve decibels (112 db).
2. CHILD SAFETY ALARM - An audible warning alarm (Transportation Safety Products, Child Safety Alarm or approved equal) shall be located near the right front corner of the bus and incorporated into the warning light system to sound as the stop arm and crossing gate close. This system shall be wired to allow the red Flasher Lights to continue flashing until the alarm completes its cycle.
3. WALK THROUGH ALARM- Bus shall be equipped with a driver "Walk Through Alarm" meeting the following specifications.

Alarm will not arm itself until the warning light/stop arm system has fully cycled. Once armed and the ignition switch is turned off;

- a. the interior lights shall turn on and remain on for sixty (60) seconds after the system has been deactivated.
- b. the driver must disarm the system by depressing a button/switch that is positioned on the header above the left rear window.
- c. if the entrance door is opened prior to disarming the system, the horn shall intermittently sound at approximate one (1) second intervals.

**ALTERNATOR**

The electric power source shall be a heavy-duty bus/truck type alternator manufactured in the USA. This alternator shall produce a minimum one hundred sixty (160) ampere output and a maximum cold continuous draw of ten (10) milliamperes. The alternator shall be mounted on the upper portion of the engine. If alternator is located within eight inches (8") of the turbo, a heat shield must be installed to direct heat away from the alternator.

Alternator shall produce a minimum of sixty percent (60%) of its maximum rated output at the normal recommended engine idle speed. Supply lead from alternator

shall be sized so as to provide at least a twenty five percent (25%) greater current carrying capacity than the designed output of the alternator (minimum 2 gauge). All alternator wiring shall be routed so as not to cross over the engine valve cover.

Alternator shall be driven by a micro-v belt (minimum six (6) groove) equipped with a spring loaded, automatic tensioning device.

## **AXLES**

Axle ratings, front springs, and frame rails shall be compatible in load rating requirements. The manufacturer shall be responsible for providing axle weight ratings necessary to meet school bus certification.

1. FRONT AXLE - The front axle shall be of a heavy duty, truck type with a capacity rating of not less than ten thousand (10,000) pounds and having a minimum king pin diameter of 1.79 inches).
2. FRONT AXLE BEARINGS - Front axle bearings shall be self-lubricating, wet type with a two (2) piece grease seal. Axle hubs shall have threaded type fill port, shall provide for visible fluid level check, and shall be filled with 75W-90 synthetic lubricant.
3. FRONT AXLE ALIGNMENT - Front axle alignment specifications for toe-in and turn radius shall be verified during pre-delivery inspections and shall be warranted for a minimum of ninety (90) days. All other adjustments and/or components affecting steering geometry shall be covered for full warranty period.
4. REAR AXLE - The rear axle shall be heavy-duty, truck type with a minimum rating of nineteen thousand (19,000) pounds. When in operation, the rear axle gears shall provide a noise level not to exceed eighty five decibels (85 db) when measured at ear level of any seated passenger.

Axle shall be equipped with a magnetic fill plug, magnetic drain plug, and shall be filled with 75W-90 synthetic lubricant. A tag shall be placed on the rear axle hosing indicating synthetic lubricant. Rear axle grease seals shall be two (2) piece design.

5. REAR AXLE RATIO - Rear axle ratio to be determined by chassis manufacturer with concurrence from the manufacturers of the engine, transmission, and rear axle for optimum operating conditions (fuel consumption and power/torque curves), at 45 MPH and achieving a top speed of approximately 60 MPH. Final approval of axle ratios shall be given by the SCDOE,T.

## **BATTERIES**

All chassis shall come equipped with a minimum of two (2) group thirty one (31), twelve volt (12v), maintenance free, commercial duty, stud-type, batteries connected in parallel. All battery cables shall be appropriately sized (minimum 000) with ring tongue lugs. The cable/lug junction shall be sealed. Individual cables shall be used to connect the batteries.

Each battery shall be of the same manufacturer and design with a minimum capacity rating of nine hundred twenty five Cold Cranking Amps (925 CCA) at zero degrees Fahrenheit with one hundred eighty (180 ) minute reserve capacity at 80 degrees Fahrenheit.

Batteries furnished by the OEM, must be available for replacement and shall be fully warranted for a minimum of twenty-four (24) months.

### **BATTERY COMPARTMENT**

All batteries shall be located in an enclosed compartment and mounted under the body floor. This compartment must be equipped with a roll out tray that is sized to accommodate easy replacement of batteries and shall be retained in a retracted position by an approved latching device.

Battery hold downs shall be provided and designed to securely retain group thirty one (BCI 31) batteries in the mounted position without chaffing of cables or possibility of contacting terminals. These hold downs shall be secured to the battery tray by a minimum of two (2) bolts, washers, and nylock type nuts.

### **BODY CONSTRUCTION**

Body must be tested and certified as complying with the standards for side intrusion tests and racking tests as outlined in the appendix. A copy of side intrusion and racking certification MUST be attached to the bid package. All buses are to be fully water tested.

1. GUARD RAILS – A minimum of four (4) replaceable guard rails shall be provided on the outside of the body on each side. The rails shall be installed over the paneling and shall run the full length of the bus except for any required openings. Pressed in guard rails are not acceptable.

The guard rails shall be approximately four inches (4") in width, formed from not less than sixteen (16) gauge sheet steel and shall be securely attached to the pillars and panels. The inside of all guard rails shall be vented and primed to prevent rusting.

Approximate location of the guard rails shall be as follows:

- a) One (1) located at bottom edge of window line,
- b) One (1) located at the seat line and extending from the service door around the rear of the body to the left windshield post (except for emergency doors),
- c) One (1) located at the floor line, and

- d) One (1) located at the bottom of the outer panels that is supported by gussets or roof bows equal in strength to the post section.
2. **SIDE SKIRT - School bus body side skirts between the front and rear axles shall extend downward to horizontal line from the center of the front spindle to the center of the rear axle. This measurement shall apply to a new unloaded school bus located on a flat level surface.**
  3. **STEPWELL - A stepwell having not fewer than three (3) steps shall be built into the right front assembly, completely enclosed with doors extending to bottom step. Step height shall be measured with ride height set to it's proper adjustment. The distance between the steps shall be equal. Stepwell shall be constructed from not less than fourteen (14) gauge galvanized steel, fourteen (14) gauge Galvalume or sixteen (16) gauge stainless steel. Bracing shall be provided across the full width of the bottom step and shall be securely fastened to provide maximum strength.**
  4. **WINDOWS - All windows shall have visors or drip moldings at the top and when installed shall provide ample protection from leakage when operating in rain. A shedding device shall be provided to divert water from drip moldings away from the service door area. This device shall not interfere with the minimum required window opening.**

## **BRAKES**

All chassis shall be equipped with four wheel/channel ABS air brakes, having a dash mounted system indicator light. System shall have self-contained means for diagnosing system failures.

Rear axle brake actuators shall be designed and mounted on forward side of axle. The S-cam application and forward wheel rotation shall be in the same direction. All air brake system component groups and part numbers shall be of the same manufacturer(s) for the total order.

### ***Minimum Brake Sizes***

<b>Axle</b>	<b>Brake Lining</b>	<b>Air Chambers</b>	<b>Slack Adjusters</b>
Front	16.5" x 5.0"	20"	Haldex
Rear	16.5" x 7.0"	30"	Haldex

1. **AIR COMPRESSOR - Bendix or Wabco with a minimum supply rating of 13.2 CFM shall be provided on all engines. The compressor shall be installed so as to provide air induction for the compressor from the clean-air side of the engine air cleaner. Coolant supply hoses if required, for the compressor shall be Type B, Class 2, level A, grade 1 hose. All hoses one inch (1") and larger**

shall be secured with stainless steel, constant torque, worm gear drive type clamps.

2. AIR DRYER - Bendix AD-9 or AD-IP air dryer shall be installed on all air brake systems. The dryer shall be equipped with a functional internal heater and automatic exhaust valve. The dryer shall be securely mounted on the frame rails or cross members and shall not extend downward more than seventeen inches (17") as measured from the top of the frame rail. The location of the dryer shall be such that the assembly is easily accessible for service and maintenance.

All plumbing from air compressor to input of air dryer shall be routed for direct entry into air dryer utilizing soft flow bends and eliminating all sumps in the air lines.

3. AIR SUPPLY LINES - All air supply lines shall be color-coded tubing as indicated below. These lines shall not be painted or sprayed with undercoating so as to obscure color-coding. Any temporary coverings used to protect the air lines from paint or undercoating shall be removed prior to delivery of vehicle.
4. AIR SUPPLY RESERVOIRS - A minimum of three (3) separate air reservoirs (wet tank, primary tank, and secondary tank) shall be provided for the braking system and shall be sized to provide a capacity that is at least ten percent (10%) greater than the capacity required by FMVSS 121.

The wet reservoir shall be equipped with automatic moisture ejection valve and the primary and secondary reservoirs shall be equipped with manual drain valves (petcocks). No portion of the reservoir tanks and/or attached valves or fittings shall be positioned above the chassis frame rails.

5. BRAKE CHAMBERS - All brake chambers shall be long stroke design and shall conform to sizes specified in table. All spring brake air chambers shall have a means for manually caging springs and manual caging device shall be suitably attached to the chambers.
6. BRAKE DRUMS - All brake drums shall be outboard mounted to facilitate brake maintenance without disturbing wheel bearings and seals
7. BRAKE LINING - All lining for air brake systems shall be constructed of asbestos-free, extended service type material complying with the minimum sizes listed in the table.
8. PARKING CONTROL VALVE - The park brake control valve shall be located on the right of the driver and shall be clearly marked (yellow). The operation of this valve shall be convenient to the driver when in a normal seated position.



The parking brake system shall be designed to function as follows, after the parking brakes are applied and the ignition switch is turned to the "OFF" position, the release of the brakes shall require:

- a) Releasing the Parking Brake Control knob,
- b) Turning the ignition switch to the "ON" position, and
- c) Depressing the service brake pedal.

This shall be accomplished by controlling the flow of air to the system and not by placing a blocking device on the park brake control knob.

9. SLACK ADJUSTERS - Slack adjusters shall be Haldex self-adjusting with external grease fittings. Grease fittings shall be positioned so as to be convenient for servicing.

## **BUMPER**

All buses shall be equipped with heavy-duty, one-piece front (minimum 3/16 " thick) and rear (minimum 3/16" thick) bumpers. Openings in the front bumper for accessing tow hooks may be provided but must be no larger in size than is required to access hooks.

All bumpers shall extend to the outer edge of the bus body at bumper top-line. Any rear bumper not fitting within one-quarter inch (1/4") of body panels must have a securely fastened rubber or metal strip to eliminate gap.

All bumpers and bumper brackets shall be securely bolted to the ends of the frame rails and/or frame brackets and side members. Bumper construction and mounting shall be of sufficient strength to support the weight of the bus (as in lifting with a jack positioned near frame end attachment points) without requiring readjustment or causing permanent distortion to the bumper, chassis, or body.

## **CAPACITY**

Capacity will be based on a minimum of twenty-seven inch (27") forward facing seat centers (measured at seat level), overall width of at least ninety-six inches (96"), center aisle width of twelve inches (12"), and thirty-nine inch (39") seats. A rear buffer zone of not less than six inches (6") shall be provided on all bodies. A two passenger seat shall be used in the rear most position on the drivers side.

### ***MINIMUM BUS CAPACITIES***

<b>Capacity</b>	<b>65 Passenger</b>	<b>71 Passenger</b>
<b>Wheelbase</b>	252" - 259"	273" - 279"
<b>Cowl to Axle</b>	228" - 230"	251" - 254"

## **DOORS**

1. BATTERY COMPARTMENT DOOR - Battery compartment shall be accessible through a door located in the side skirt and hinged toward the front. This

door shall be furnished with a flush mounted, adjustable, key-locking, metal latch (key number CH 545).

2. FUEL FILLER DOOR - A suitable door of not less than sixteen (16) gauge steel shall be installed over fuel filler opening on the right side of body. This door shall be spring-loaded and shall remain in a closed or open position. Door to be hinged toward the front and equipped with a keyed type lock (key number CH 545).
3. SERVICE DOOR - Service door shall be air operated, outward opening and designed to prevent accidental openings. The door shall be located on the right side of the bus and controlled by the driver.

Door control lever/switch shall be mounted in an approved location that is easily accessible to the driver. Electrical door switch shall not operate when ignition is not in "ON" position.

Door shall be equipped with an emergency release control located in or adjacent to the door header panel and designed to exhaust air supply from the operating mechanism. This control shall be clearly and permanently marked, including operating instructions. Door operating mechanism shall be fully adjustable, located overhead of door and concealed behind a removable access panel.

Door when fully opened shall provide a minimum clear entrance area of twenty-four inches (24") wide and seventy-six inches (76") high. A suitable drip molding or rail to shed water shall be located above the door.

A stainless steel assist rail (minimum 20" length) shall be installed on all units on the windshield side of the entrance stepwell. This rail shall be securely mounted and installed in such a manner as to afford easy accessibility to small children during bus entry and/or egress.

## **DRIVELINE**

Drive shafts shall be provided with adequate protective metal guards to prevent whipping through the floor or dropping to the ground in the event of shaft breakage. All drive shafts shall be properly phased and balanced to eliminate vibrations.

## **EMERGENCY EQUIPMENT**

All emergency equipment shall be securely mounted in the driver's area. The overhead compartment will be utilized for all items except the Seat Belt Cutter and Fire Extinguisher. This compartment shall be of sufficient size to allow storage and easy removal of all emergency equipment.

This compartment shall be finished on the inside and shall allow for mounting the first aid kit and body fluid kit in an upright position. This compartment shall be

boxed on the ends to prevent objects from sliding and/or falling to the left or right of the opening.

This compartment shall be covered by a door, appropriately lettered, hinged at the top, and adequately secured (non-locking). The compartment shall provide a device for retaining the door in an open position during inspection or removal of emergency equipment.

1. BODY FLUID CLEAN-UP KIT - All buses shall be equipped with a removable, moisture proof and dust proof body fluid clean-up kit meeting the requirements of the 2005 National School Transportation Specifications and Procedures.
2. FIRE EXTINGUISHER - All buses shall be equipped with a dry chemical, compressed air type fire extinguisher bearing Under Writer's Laboratories, Inc. rating of not less than 2A-10BC (5 lbs). The extinguisher shall be equipped with a pressure gauge and a flexible rubber hose.

The fire extinguisher shall be securely mounted in an area approved by the SCDOE,T. Mounting must allow reading the pressure gauge without removing the extinguisher from the bracket.

3. FIRST AID KIT - All buses shall be equipped with a removable, moisture proof and dust proof first aid kit meeting the requirements of the 2005 National School Transportation Specifications and Procedures.
4. SEAT BELT CUTTER - A seat belt cutter shall be provided on all buses and shall be mounted in an area that will provide easy access to the driver while in a seated position. This cutter shall incorporate replaceable, stainless steel blades and shall be designed to eliminate the possibility of the operator or others being cut during use. (Tie Tech Safecut or approved equal).
5. WARNING DEVICES - All buses shall be equipped with three (3) reflectorized triangles, road-warning devices. These devices must meet FMVSS 125 requirements, shall be secured in a box and the box shall be secured in the compartment.

## **EMERGENCY EXITS**

All emergency exits shall conform to FMVSS 217 and shall be appropriately marked with operating instructions.

1. EMERGENCY DOORS - There shall be an emergency door located on both the left side and rear of the bus. The left side emergency door shall be located near the center of the bus. Exterior door handles shall be contoured to allow grasping and pulling the door open.

These doors shall have a self canceling, latching mechanism that holds the door in an open position to prevent it from closing during emergencies and evacuation drills. The door shall be reinforced to prevent bending when pushed against latching mechanism.

Side emergency door shall be equipped with an upper glassed opening (minimum of 340 sq/in). Rear emergency door shall be equipped with upper (minimum of 500 sq/in) and lower (287 sq/in minimum) glassed openings.

2. EMERGENCY PUSH OUT WINDOWS - All buses shall be equipped with four (4) forward hinged, push out windows; two (2) on each side. Positioning of these windows shall be staggered.
3. EMERGENCY ROOF HATCHES - All buses shall be equipped with two (2) emergency roof hatches. These hatches must be equipped with a simple release mechanism that is operable from both inside and outside the bus (Specialty 9245 or Transpec 1970).

### **EMERGENCY EXIT BUZZERS**

1. EMERGENCY DOORS - The emergency door locks shall contain a switch activated by one quarter inch (1/4") travel of the lock to which is attached audible buzzers to alert the driver when the emergency door is not properly secured. There shall also be a buzzer/audible alarm with indicator located, in the driver's area to warn of an improperly secured emergency door.
2. OTHER EMERGENCY EXITS - All other emergency exits will be equipped with the necessary switches, wiring, and buzzer or audible alarm with indicator located in the driver's area, so as to alert the driver when either of the latches for these items is moved toward a released position.

### **ENGINE**

The chassis shall be equipped with a heavy-duty, electronically controlled diesel engine. All engines must be unaltered current production models and shall meet all applicable Federal Regulations at the time of purchase. Electronic links between the engine and transmission shall interface to insure optimal operating efficiency. Easily accessible data access ports shall be provided.

All engines shall be equipped with an ignition switch operated electric shutdown. All buses purchased under a single order shall be keyed alike. A minimum of one (1) spare key shall be provided with each bus. Installation shall provide for technicians to access routine service/maintenance areas without hazard.

### **Approved Engines**

<b>Manufacturer</b>	<b>Model</b>
Caterpillar	ACERT C7
Cummins	ISB
Navistar	MAXXFORCE DT
Navistar	MAXXFORCE 7
Mercedes	MBE 906

#### **Performance Requirements**

<b>Capacity</b>	<b>HP</b>	<b>Torque</b>
65 - 71	200	520

Turbo charger and water pump shall carry same warranty as engine. Turbo charger failure caused by lack of lubrication shall not be cause to void the warranty. All engines shall be equipped with a thermostatically controlled cooling fan.

Molded hoses shall be used in all applications requiring bends, turns, or angles (multi-ribbed flex hoses are not acceptable). All hoses shall be of Type B, Class 2, level A, grade 1 construction. All hoses one inch (1") and larger shall be secured with stainless steel, worm gear driven, constant torque clamps. Any unused, temporary plugs shall be converted to permanent plugs prior to delivery. All engine coolant shall utilize a 50/50 mixture (-34 F freeze/265 F boil over) of deionized water and extended life, inorganic acid type, antifreeze.

Engines shall be equipped with corrosion resistant metal hose bibs for use in heating systems (minimum 1"). No screws or other sharp objects shall protrude into the engine servicing area. All wiring shall be securely fastened with looms and clips.

### **EXHAUST SYSTEM**

The muffler and all exhaust system components shall be made of corrosion resisting material and shall carry the same warranty as the engine. Manufacturer must insure that exhaust temperature during any loading/unloading activity with the engine running shall not be great enough to produce first degree burns. The bus shall not automatically enter a regeneration cycle if vehicle speed is not greater than five (5) miles per hour. During the manual regenerations cycle the exhaust temperature when measured six inches from the exhaust tip shall not exceed six hundred degrees Fahrenheit (600F).

Each component of the exhaust system shall be securely attached utilizing heavy duty, vibration-absorbing type mounts. The muffler shall be securely mounted to the frame members at a minimum of two (2) points. Tail pipe shall be turned down at the tip and exit at the bottom edge of the rear bumper or exit through the rear bumper near the left rear corner. If tail pipe exits through rear bumper sufficient clamps/brackets shall be provided to eliminate rattles. No part of the exhaust system shall be located within the angle of departure and at no point shall any part of the system be positioned closer to the ground than the body side skirts.

### **FAN, ELECTRIC**

One, dual speed, six inch (6"), twelve-volt (12v) electric fan shall be provided for air circulation. This fan shall have a metal, corrosion resisting guard with metal blades and shall be individually switched (Baader Brown #0900-072-000 or approved equal). Location shall be near the center of the windshield, but shall not obscure visibility of the right side rear vision mirrors. Dash integrated forced air ventilation system is acceptable in lieu of electric fan.

## **FLOOR**

1. FLOOR COVERING - The floor covering shall be smooth, black/charcoal in color, and fire resistant. The flooring shall have a minimum overall thickness of one eighth inch (1/8") and a minimum dry static coefficient of friction of 0.6 as determined by ASTM D 1894-93.

The floor covering over openings shall be cut in sections to conform to any removable floor panels. The covering shall be removable with the panel without disturbing the flooring in the other areas. The adhesive for laminating floor covering to the floor shall be a water and fire resistant type.

The aisle and entrance platform area shall be covered with an aisle type, ribbed flooring having a minimum thickness of three-sixteenths inch (3/16").

All steps including top of nosing, shall be covered with raised pebble design material complying with the requirements of the 2005 National School Transportation Specifications and Procedures.

All joints in the floor covering area shall be sealed and covered with an approved one inch (1") wide, sixteen (16) gauge rust proof metal strip or molding. An additional cover molding shall be provided around the body wall at the floor line to lap over the floor covering. The molding may be a separate applied molding or it may be a part of the body panel but, in either case, it shall fit snugly upon the floor covering so that dirt cannot readily work underneath the edges.

3. FLOOR PLATE - Floor plate shall be a minimum of fourteen (14) gauge prime commercial quality, zinc coated steel having not less than one and one quarter (1 1/4) ounces of zinc per square foot or fourteen (14) gauge Galvalume.

Floor plate not complying with specifications listed above, shall require a written warranty against failures due to corrosion for a minimum of fifteen (15) years. This warranty shall cover the full cost of repairs and shall be provided at the time of the Pilot Inspection.

All floor joints shall be gas tight to prevent the entrance of heat and fumes. Suitable openings shall be provided for servicing any chassis components such as fuel tank sender and fuel line connections. All openings in floor plate shall be sealed and covered by a metal plate.

## FRAME

All chassis frames shall be formed from full depth, "C" channel steel and shall be a continuous section from bumper to bumper. Each frame rail shall comply with the specifications listed below.

### *Frame Rail Specifications*

<b>Yield Strength</b>	<b>Section Modulus (Min.)</b>	<b>RBM (Min.)</b>
50,000 psi	12.25 cu/in (nom)	610,000 in/lbs

Section modulus shall be nominal calculations based on the design dimensions of the frame rail. This shall include any sections that may have been modified during assembly. Any notched areas of a frame rail shall be reinforced utilizing frame liners sufficient in size and strength to insure compliance with the minimum section modulus requirements. There shall be no extra holes drilled in the frame rails.

A minimum of five (5) cross members shall be provided and shall be formed from a minimum of three-sixteenths inch (3/16") steel. Cross member mounting flange shall be a minimum of ninety percent (90%) of the frame rail height. At least one fully boxed or "double dogbone" cross member shall be installed at a point approximately midway between the front and rear axles.

The frame and all attached components shall be thoroughly coated with paint or undercoating. Precautions shall be taken to insure that color coded items (air supply tubing, wiring, etceteras) are not painted.

Frame rails and/or cross-members not complying with all specifications listed above, shall require a written warranty covering all failures (excluding accident damage) for a minimum of fifteen (15) years. This warranty shall fully cover the cost of repairs necessitated by cracking, breaking, and/or bending and shall be provided at the time of the Pilot Inspection.

## FUEL FILTER

All engines shall be equipped with a primary fuel/water separator filter and a secondary fuel filter of the engine manufacturer's standard type. The fuel/water separator shall be designed for easy detection of water accumulation without removal of filter and shall be equipped with a built in drain valve.

## FUEL TANK

An aluminized steel fuel tank shall be furnished on all chassis. Fuel tank vent shall be positioned so as to eliminate the possibility of fuel spillage when the bus is parked on uneven surfaces and shall have a hose installed that is routed toward the rear of the chassis.

### *Minimum Fuel Tank Specifications*

<b>Wheelbase</b>	<b>Tank Capacity</b>	<b>Location</b>
252" - 259"	60 gal.	Between Frame Rails
273 " - 279"	100 gal.	Between Frame Rails

No portion of the fuel tank/cage assembly shall be located within the angle of departure. The fuel tank neck must be metal, securely mounted and shall be equipped with a standard non-vented cap. The bus body floor shall include an access plate for servicing and/or removing the sending unit.

## **GLASS**

All glass shall be legibly and permanently marked and shall conform to the American Safety Code for Safety Glazing Materials. There shall be no unfinished, exposed glass edges.

1. **WINDSHIELD** - The windshield shall be polished plate glass, AS1. The windshield glass shall be shaded with heavy tint on the upper portion.
2. **WINDOW AND DOOR GLASS** - All window and door glass shall be laminated, minimum 7/32" thick. Glass used in entrance door and driver's side window shall be AS2. Glass used in passenger windows and emergency doors shall be tinted AS3 having twenty eight to thirty one percent (28% to 31%) light transmittance.

## **HEATER AND DEFROSTER**

Heater/defroster system shall be capable of maintaining bus interior temperature as specified in test procedure SAE J2233. The heat source for this system will be engine coolant. The front heater shall utilize a combination of fresh air (approximately 60%) and re-circulated air. Any additional heaters may be re-circulating type.

1. **BLOWERS** - The heater system shall be equipped with a minimum of four (4) electric, two (2) speed, and motor driven blowers. The total air output of the heater blowers shall not be less than fifteen hundred cubic feet per minute (1500 CFM) when measured on high speed.

Air intake shall be sufficient to maintain all blowers at full force. When all blowers are operating at full speed; any noticeable reduction in air output for any blower motor will disqualify heating system.

The heater cover shall contain panels that are easily removable for access to heater motors without requiring the removal of a seat.

2. **BOOSTER PUMP** - To insure adequate coolant flow to the heater/defroster system, all heater systems shall be equipped with a heavy duty booster pump. This pump shall have a metal housing and shall be rated for a minimum of ten (10) GPM at three (3) PSI. A separate switch on the driver's control panel shall control the booster pump. Booster pump may be controlled by heater switch(es).



3. CORES - The heater cores shall be a heavy-duty coil type. The coil shall be high-pressure copper or aluminum tubes with aluminum plate type fins with self-spacing, die formed collars completely covering the tubes. Cores of the cellular type, not made of 100% brass or copper, will not be accepted.
4. DEFROSTER - The defroster installation shall provide sufficient airflow outlets to provide for defrosting/clearing the full length of the windshield. Additional outlets shall be provided; a minimum of one (1) each at the left and right sides, to allow for defrosting/clearing the driver's side window and entrance door glass. A suitable device shall be provided to preclude dropping foreign objects through the defroster outlets into defroster motor area.

Rubber or fabric defroster hose shall not be used for conducting the heated air from the defroster blower(s) to the defroster outlets. Temperature operating range for duct hose must be minus forty to one hundred sixty degrees Fahrenheit (-40F to 160F).

5. FRESH AIR INLET - The fresh air inlet shall provide a slight super charging or pressurizing effect when the bus is in motion. This inlet shall be located and designed to prevent dust and dirt from entering through the system. If a filter is installed, it must be re-useable type that is easily removable for servicing.
6. HEATER(S), FRONT - The front heater arrangement shall supply heated air to the driver's compartment area and also toward the rear into the passenger area.
7. HEATER(S), REAR - Rear heater(s) shall be located under passenger seat in the rear one third (1/3) of the bus and shall not obscure foot room of passengers seated behind the heater. Heater unit will be protected so as to alleviate damage to the heater and components from passengers under normal operating conditions. All plumbing shall be secured and adequately protected. The heater housing and related components shall be insulated/protected to alleviate excessive surface temperatures.
8. PLUMBING - All coolant hoses used for heater supply and installation shall be of a Type B, Class 2, level A, grade 1. All hoses one inch (1") and larger shall be secured using stainless steel, constant torque worm gear driven type clamps. These hoses shall be adequately supported and protected to prevent body vibrations from being transmitted through the hoses to the heater core inlet and outlet nipples.

Brass or copper elbows shall be used where coolant hoses must turn or change direction sharply. A brass or copper tube assembly shall be provided at any point where the hoses must pass through the floor, body panels, and/or bulkhead. Plumbing at the emergency door area must not create a trip hazard.

All hoses routed on the inside of the bus shall be covered by approved panels and shall be secured at points not to exceed three feet (3') in distance. There shall be no exposed hoses in the interior compartment of the bus.

Any antifreeze added during heater installation must be compatible with that installed by the engine manufacturer. Coolant system inhibitors if utilized must be adjusted after installation of heater system.

9. SWITCHES/CONTROLS - All switches for control of the heater blower motors shall be grouped together. Separate switches shall be used to control individual blower motors.

Two (2) engine mounted water control valves, one quarter (1/4) turn, brass, ball type shall be installed; one (1) each on the coolant supply and return hoses for the heaters. An in-line bleeder screw assembly shall be provided near the valve on the return side.

One (1) corrosion resistant water control valve, one quarter (1/4) turn, brass, ball type or approved equal shall be controlled from the driver's area to allow closing off coolant flow to heaters on warm days. An electronic switch or remote mounted control conveniently located to the driver may be used to control this valve.

## **HOOD**

The hood and fenders shall be composite material, shall tilt forward as one piece, and shall be equipped with inner fenders to control wheel splash. An integral type pull shall be designed into the hood, which shall have a lip sufficient to prevent wet fingers from slipping. The hood shall be designed so that it closes to a fully seated position when lowered from the front and requires less than a twenty (20) pound pull to open.

## **HORN**

All horn(s) shall be securely mounted and located away from the wheel splash area so as to prevent contamination from road spray.

## **INSTRUMENTS AND INSTRUMENT PANEL**

The instrument panel shall be designed to eliminate glare on the gauges when operating the bus in bright sunlight. Integrated cup holders shall not be provided.

All instruments and gauges shall be mounted in such a manner that each is visible to the driver while in a normal seated position. The following instruments and gauges are required (lights in lieu of gauges are not acceptable):

1. AIR PRESSURE GAUGE(S) - Shall include warning light and buzzer to indicate low air pressure. Single gauge with two (2) needles of contrasting colors is acceptable.

2. COOLANT TEMPERATURE GAUGE - Shall include a warning light and buzzer to indicate high water temperature based on engine manufacturer's recommendation. Water temperature sensor shall be located on the engine.
3. ENGINE SERVICE LIGHT - A dash-mounted light shall be provided to indicate if the electronic engine control module detects a malfunction.
4. FUEL GAUGE
5. HIGH BEAM HEADLIGHT INDICATOR - Must have replaceable bulb or be LED lighted.
6. INSTRUCTIONS - Any special operating instructions for engine or transmission shall be displayed in an approved location on the dash panel.
7. LOW COOLANT WARNING - Shall include a warning light and buzzer to indicate low coolant levels in the de-aeration tank.
8. ODOMETER - Shall indicate a minimum of six (6) digits not including tenths (1/10) of a mile and shall be readable with ignition switch in the "OFF" position. Additionally, tenths (1/10) of a mile must be displayed on either the Odometer or Trip Odometer.
9. OIL PRESSURE GAUGE - Shall include a warning light and buzzer to indicate low oil pressure based on engine manufacturer's recommendation. If mechanical oil pressure gauge is provided, all inside plumbing shall utilize stainless steel braided hose.
10. SPEEDOMETER, ELECTRONIC
11. TACHOMETER/ENGINE HOURMETER - Hourmeter shall be wired to operate only when engine is running and shall be readable with ignition switch in the "OFF" position.
12. TRANSMISSION TEMPERATURE GAUGE
13. TURN SIGNAL INDICATORS, LEFT/RIGHT - Must have individually replaceable bulbs or be LED lighted.
14. VOLTMETER - Shall have a graduated scale capable of indicating up to sixteen volts (16v), shall indicate battery voltage, and shall be off when the ignition switch is in the off position.

Note: Warning light and buzzer for oil pressure, coolant temperature and low coolant may be combined.

## **INSULATION AND UNDERCOATING**

1. **ENGINE COMPARTMENT** - Noise barrier insulation shall be provided to reduce interior engine noise level at the driver's right ear to a maximum of seventy-eight decibels (78 db).

The recorded noise level shall be an average of four (4) readings taken at ear level of an adult male seated in the driver's seat and shall be taken with the vehicle stationary. The engine shall be operating at maximum rated revolutions per minute (RPM), all windows and doors closed, no large reflecting surfaces located within fifty feet (50') of the vehicle and the noise level meter set on the "A" scale.

2. **ROOF/SIDES** - The space between all interior and exterior body panels shall be insulated using a minimum of one and one half inches (1 1/2") of insulation having a minimum R-5.75 rating. This insulating material shall also be installed in all voids created by roof bows, body caps, etceteras.
3. **UNDERCOATING** - The entire underside of the bus; to include body and wheel housings shall be coated to a minimum depth of one sixteenth inch (1/16") with high quality automotive type underseal to protect the body and chassis from rust and to seal and insulate the floor. Precautions shall be taken to insure that color coded items (air supply tubing, wiring, etceteras) are not coated.

## **INTERIOR**

The finished inside body height shall be a nominal seventy-six inches (76") minimum measured at any point on the longitudinal centerline from the front vertical bow to the rear vertical bow.

## **LAMPS AND DIRECTIONAL SIGNALS**

All lighting equipment shall be furnished to comply with the FMVSS 108 and the laws and regulations of the State of South Carolina. All LED (light emitting diode) lamps shall have a hard shell coating to protect from chemicals and abrasion. The lighting equipment provided shall at a minimum include:

1. **BACK-UP LAMPS** - Dual, four inch (4"), LED back up lamps meeting SAE requirements shall be installed on rear of bus and activated by a switch on the transmission or transmission shift control.
2. **CLEARANCE/MARKER LAMPS** - Minimum of twelve (12) required; one (1) installed on each of the four (4) roof corners, two (2) clusters of three (3) mounted between the clearance marker lamps on the front and the rear of the bus at the roofline, and one (1) mounted on each side at the approximate centerline of bus. If lamps are not recessed they shall be armor type.

The lamps positioned from the center of the bus forward shall be amber in color. The lamps positioned on the rear of the bus shall be red in color. All

lamps shall be LED with sealed electrical plugs. Clearance/marker lamps shall be controlled by the chassis headlight switch and wired to burn with chassis parking lights or headlights.

3. CONTROL PANEL ILLUMINATION - All switches/controls located on the driver's control panel shall be lighted for easy identification. This shall be performed in such a manner that will not create excessive glare for the driver. If switches/controls are self-illuminated, individually replaceable bulbs or LED's must be used.
4. DAYTIME RUNNING LIGHTS - All buses shall be equipped with DRL (low beam headlights) that are wired to automatically operate anytime that the engine is running. These lights shall not turn off by applying the parking brakes.
5. SCHOOL BUS SIGNAL LAMPS - All buses shall be equipped with an alternately strobing School Bus Signal Lamp system. This system shall consist of four (4) red LED signal lamps and four (4) amber LED signal lamps. Each lamp shall provide a minimum of 38 sq/in of lighted surface area.

Lights shall be actuated by a heavy-duty momentary contact switch that is mounted to the driver's left near the front of the control panel.

Signal lamp system shall operate as follows:

- a) Right and left signal lamps shall strobe alternately.
  - b) The system shall be wired so that the amber signal lamps are activated only by hand operation.
  - c) With entrance door closed, activate momentary contact switch. Amber pilot light and amber signals shall go on.
  - d) The amber signal lamps will automatically be deactivated and the red signal lamps will automatically be activated when the bus service door is opened.
  - e) When the service door is closed the Child Safety Alarm will automatically be activated and the stop arm/crossing gate will automatically be deactivated. The red signal lamps shall remain on until the Child Safety Alarm has cycled.
  - f) A fail-safe/override switch (on/off) shall be installed to operate the red signal lamps, stop arm and crossing gate if other system fails. When this switch is activated the red pilot light, red signal lamps, stop arm, stop arm lamps, and crossing gate shall be turned on.
  - g) Two (2) pilot lamps, one (1) red and one (1) amber shall be positioned so as to be easily visible to the driver even in bright sunlight. These lamps shall operate when the respective amber or red flasher system is activated.
6. HAZARD LAMPS - The hazard lamp system shall be controlled by a heavy-duty switch, which is easily identifiable.

7. HEADLAMPS – A headlamp system using Halogen, fleet/truck type, extended life, bulbs (minimum rating of 2,000 hours @ 14.0 volts) shall be installed. A single dash mounted headlight switch shall control the headlamps, park lights, clearance/marker lights, and dash/control panel lights. The headlight dimmer switch shall be located on the steering column.
8. INTERIOR LIGHTING - Interior lighting shall consist of a minimum of eight (8) flush mounted dome lamps. A four inch (4"), white, LED stepwell light shall be wired into the chassis headlight circuit in such manner that it can burn only if chassis lights are "ON", the entrance door is open, and the ignition switch is in the "ON" position.
9. LICENSE PLATE LAMPS – Two (2) rear license plate lamps shall be provided one (1) on each side of the rear body panel (Truck-Lite 15205 or approved equal).
10. PARK LAMPS - Two (2) amber color park lamps shall be visible from the front of the bus.
11. STOP/TAIL LAMPS - All buses shall be equipped with four (4) combination red stop/tail lamps. Two (2), LED lamps providing a minimum of 38 sq/in of lighted surface area for each lamp shall be located just below the rear windows, inside of the turn signals and as far apart as possible. Two (2), LED lamps four (4) inch in diameter shall be located at the approximate floor line and as near the outer edges of the bus as possible. Stop lamps shall be activated by the service brakes and shall emit a steady light when illuminated.
12. STROBE LAMP - All buses shall be equipped with a white strobe lamp having a minimum rating of ten (10) joules, double flash, and a maximum height of six inches (6"). The strobe lamp flash tube shall be warranted for a minimum of twelve (12) months. All other components shall be covered for the full warranty period.

Lamp shall be located on the roof centerline within thirty-six inches (36") from the rear of bus. This light shall be wired so as to operate with the ignition switch and the circuit shall be protected so that a short at the strobe lamp will not adversely affect any other component. A protective guard angled from the front shall be designed and installed to allow limbs or low hanging objects to ride over the lamp.

13. TURN SIGNAL LAMPS - All buses shall be equipped with two (2), LED lamps providing a minimum of 38 sq/in of lighted surface area for each lamp mounted on the rear as near the outer edges of the bus as possible. All buses shall be equipped with two (2), fender mounted turn signals visible from the front of the bus.

Additionally, two (2) side mounted, red turn signal lamps (same as clearance lamps) shall be mounted above the rear tires and centered between the top two (2) rub rails.

The design of the system shall be such that if any signal lamp fails to function by reason of a burned or open circuit, the action of the dash mounted indicator lamp will indicate a malfunction.

## **LETTERING**

All lettering to be painted or high quality automotive type vinyl and shall be black unless specified otherwise herein.

1. EMERGENCY EXITS - The words "EMERGENCY EXIT" shall be applied in two inch (2") letters directly above each emergency exit on both the inside and outside of the bus.
2. FRONT & REAR - The words "SCHOOL BUS" shall be applied in eight inch (8") letters with a one inch (1") minimum stroke. These shall be located in one line and between the flashing lights with "SCHOOL BUS" being placed on a retro reflective background approximately ten inches by thirty-six inches (10"x36").
3. FUEL DOOR - "DIESEL" in two inch (2") letters shall be applied directly over the fuel filler door.
4. INTERIOR - The words "RATED SEATING CAPACITY, \_\_\_\_ PASSENGERS" shall be applied in two inch (2") letters near the ceiling, at front of bus, above the windshield and visible to all passengers.
5. INTERIOR - The words "EMERGENCY EQUIPMENT COMPARTMENT" in one and one half inch (1 1/2") red letters shall be applied on the overhead compartment in the driver's area used for storing emergency equipment. Individual emergency equipment items shall be listed using one inch (1") red lettering.
6. INTERIOR - Each seat shall have number/letter designations applied overhead using two inch (2") lettering. The number designations shall be by row starting with number one (1) at the front. The letter designations shall be L for left side and R for right side as viewed from a forward facing position.
7. NUMBERING - The SCDOE,T shall provide an eight (8) digit identification number to the contractor for each bus constructed. These numbers shall be applied using four inch (4") digits, except as noted, in the following locations:
  - a) Left Side - below driver's window and centered between the top two (2) guard rails,

- b) Right Side - just aft of the service door and centered between the top two (2) guard rails,
  - c) Rear - Centered between the upper and lower windows on the emergency door, and
  - d) Inside - above service door (2" lettering)
8. SIDES - The words "SOUTH CAROLINA PUBLIC SCHOOLS" in six inch (6") letters shall be applied directly under windows and centered front to rear.

### **LICENSE PLATES**

All buses shall be equipped to accommodate license plate installation as follows; two (2) locations on the rear (one (1) on either side) and one (1) location on the front bumper. All necessary attaching hardware shall be included.

Two (2) blank metal plates, (minimum 22 gauge), approximately six inches by twelve inches (6"x12") with rounded corners shall be painted on both sides and installed one (1) on the right rear and one (1) on the front bumper.

### **LOGOS, MANUFACTURER'S**

No manufacturer's logos or names may be placed on the bus exterior except a small nameplate may be installed in an approved area.

### **LUBRICATION**

Chassis lubricating system shall be high-pressure type with standard hydraulic type grease fittings. Fittings shall quick attachment type and shall be positioned so as to be easily accessible for maintenance and service without removal of panels/components.

### **MIRRORS**

1. EXTERIOR MIRRORS - All buses shall be equipped with an exterior mirror system. Certification of the indirect view provided by the mirror system and the driver's direct view of the ground shall be provided at the time of the pilot inspection. In addition, the following specifications shall be met:
  - a. REAR VISION MIRROR SYSTEM - All buses shall be equipped with a rear vision mirror system, which incorporates independently adjustable convex and flat glass mirrors. These shall be mounted, (1 convex and 1 flat glass) on both the left and right sides of the bus (Mirror Lite, Rosco, or approved equal).
  - b. CROSSVIEW MIRROR SYSTEM - All buses shall be equipped with a cross view mirror system. This system shall incorporate not less than one (1) mirror installed on each front corner of the bus.

All mirrors shall be mounted so as to isolate them from vibration. Any bracketing or supports shall be adequately braced to eliminate breakage. If mounting is secured through fiberglass and/or body



panels; bolts, locking nuts, and backing plates shall be used. The mirror manufacturer must approve all mirror mounting and bracketing.

2. INTERIOR MIRROR - (1) interior, driver adjustable (6" x 30") convex rearview mirror (Tiger 1544 w/ bracket or approved equal) shall be mounted above windshield to provide the driver with full view of bus interior.

## **MOUNTING**

The body shall be properly insulated from the chassis by use of rubber and/or fiber inserts at every contact point. The body shall be securely attached to the chassis frame with mounting bolts and clamps. These shall be of a design that eliminates clamps rotating around the bolts during normal operation.

## **MUD FLAPS**

Mud flaps shall be provided for the rear wheels, shall be black rubber and shall display no manufacturer's logos.

## **PAINT**

All paint shall be lead free, high baked enamel, thermo-setting acrylic enamel, catalytic acrylic or two (2) part polyurethane enamel.

Prior to application of the finish coats to the body; all surfaces shall be cleaned of grease, foreign matter, excessive body caulking and sealing material and then treated as per paint manufacturer's recommendation for proper paint adhesion.

School Bus Yellow paint shall meet the color standard as specified in the School Bus Manufacturer's Technical Council Publication SBMTC-008 and shall have a finish gloss rating of at least ninety (90) at sixty (60) degrees and an average distinctness of image rating of at least sixty (60). Topcoat shall be applied for a total dry film thickness of 1.8 mils to 2.2 mils over all painted surfaces.

Body paint finish coats shall be warranted for a minimum of sixty (60) months (100% parts and labor) for adhesion, color retention, and gloss retention. Acceptable variations from original paint finish are as follows:

1. ADHESION - Paint and priming compounds shall not fail to adhere to the bus with normal use and care.
2. COLOR RETENTION - During the first thirty-six (36) months from the in-service date the color shall not shift colors more than four (4) Delta E from the centroid as specified in the School Bus Manufacturer's Technical Council Publication SBMTC-008. During the sixty (60) month warranty period the color shall not shift more than eight (8) Delta E from the centroid as specified in SBMTC-008.
3. GLOSS - During the first thirty-six (36) months from the in-service date the gloss reading shall not fall below sixty (60) at sixty (60) degrees. During the

sixty (60) month warranty period the gloss reading shall not drop below thirty (30) at sixty (60) degrees.

All measurements shall be the average of twelve (12) readings taken at various points on the bus but no reading shall be more than three (3) points under the stated minimum and shall be taken after the bus is thoroughly washed to remove road film and dust.

## PAINT COLOR

### *Color Requirements*

Black, Gloss	Bumpers, guard rails, blank license plates, and chassis.
Gray	Wheels
Interior	Manufacturer's Standard at time of production (except aluminized or Galvalume panels)
White	Roof panels down to within five inches (5") of the window drip rails
Yellow	(National School Bus Yellow) Exterior paneling and hood
Other	Seat frames may be manufacturer's standard,

## PANELING

All paneling shall be installed in a manner that will eliminate wrinkling, buckling and cracking.

1. EXTERIOR - Roof panels shall be of not less than twenty (20) gauge, sheet steel panels formed to fit the roof bows. Panel joints shall overlap at the bows for the full width of the bow and shall be securely riveted or bolted to bow flange. All joints shall be sealed to render them completely watertight.
2. INTERIOR - The interior panels shall be embossed aluminized steel or Galvalume not less than twenty-two (22) gauge and securely fastened to frame members from the bottom of side windows to top of seat rails.
3. HEADLINING - The interior roof panels, except perforated sections shall be not less than twenty-two (22) gauge sheet steel. A minimum of the first two sections (minimum of 50 inches) at front shall be sheet steel perforated acoustical paneling. (An approved scrim type material shall be installed between the acoustical panels and insulation to eliminate insulating particles dropping through perforated panels.) The acoustical panels shall have a minimum of two inches (2") non-perforated steel at lapped joints or shall have perforated edges folded and doubled for attachment to roof bows.
4. SIDE, FRONT, AND REAR PANELS - Panels shall be not less than twenty (20) gauge and shall be securely fastened to each body post.

## RADIATOR/AFTERCOOLER

Heavy-duty, truck type radiator exceeding engine and transmission manufacturers heat rejection requirements shall be furnished and mounted so as to prevent undue

strain and vibration being transmitted to it through attaching parts. The radiator and coolant recovery system shall carry the same warranty as the engine.

The radiator core shall be a welded coolant tube to header joint type. Aftercooler shall be securely mounted so as to alleviate rubbing against the radiator. All piping for the aftercooler shall be aluminized steel.

All cooling systems shall be equipped with a coolant recovery/deaeration system with over flow vent hose to route coolant away from engine compartment. A means for visibly checking the coolant level without opening the system shall be provided. The recovery/deaeration tank will have a decal affixed to identify the type of coolant used in the system.

All plumbing shall be adequately secured and braced. All hoses shall be of a Type B, Class 2, level A, grade 1 construction. All hoses one inch (1") and larger shall be secured using stainless steel, constant torque, worm gear driven clamps. Hoses making sharp bends, turns or angles shall be molded hoses. Flex/ribbed hoses are not acceptable. Unless otherwise specified, all rigid coolant plumbing shall be stainless steel.

Any component or plumbing of the Radiator/Aftercooler systems located closer to the ground, than the lower edge of the front bumper, shall be protected by skid plates. There shall be no additional coolers mounted between the radiator and the aftercooler. Design and mounting shall be such that will prevent the accumulation of dirt and debris between the radiator and aftercooler and shall provide for easy cleaning without removing any component.

### **RECOVERY ATTACHMENT POINTS**

Recovery points shall be provided on both the front and rear of the bus. These points shall allow recovery of the bus without causing damage to either chassis or body parts, when pulled horizontally anywhere from zero (0) degrees through a forty-five (45) degree cone angle or vertically, based on pull strength requirements listed below.

#### ***Pull Strength Requirements***

<b>Direction of Pull</b>	<b>Single Recovery Point</b>	<b>Dual Recovery Points</b>
Horizontal @ 0 Degrees	100% of GVWR	50% of GVWR (each Point)
Horizontal @ 45 Degrees	140% of GAWR	70% of GAWR (each Point)
Vertical (perpendicular to frame)	100% of GAWR	50% of GAWR (each Point)

### **REFLECTIVE CONSPICUITY MARKINGS**

All retro reflective material used on the bus shall be a Type V as defined by ASTM-D-4956-90.

1. EXITS - All emergency exits shall be outlined on the outside of the vehicle with a retro-reflective yellow material approximately one inch (1") in width.
2. FRONT - "SCHOOL BUS" lettering on the front shall be backed by retro-reflective yellow material.
3. REAR - "SCHOOL BUS" lettering on the rear shall be backed by retro-reflective yellow material. Additionally, the rear of the bus body shall be marked with a strip of retro reflective yellow material. This material shall be approximately two (2") in width and shall be applied as follows: extending from the left lower corner of the "SCHOOL BUS" sign across to the left side of the bus, then vertically down to the top of the bumper, across the bus on a line immediately above the bumper to the right side, then vertically up to a point even with the strip placement on the left side and concluding with a horizontal strip terminating at the lower right corner of the "SCHOOL BUS" sign.
4. SIDES - The sides of the body shall be marked with retro-reflective yellow material at least two inches (2") in width, extending the length of the bus body, and located (vertically) as close as practicable to the belt line.

### **REFLECTORS**

The body shall be equipped with eight (8), three inch (3") acrylic plastic reflectors mounted in aluminum frames (Peterson #472 or equal). Three (3) reflectors shall be mounted on each side of the bus, one (1) at the front, one (1) at the center, and one (1) at the rear. Two (2) reflectors shall be mounted on the rear of the bus located as far apart as body contours will permit.

All reflectors shall be attached by a minimum of two (2) screws or rivets. Reflectors mounted in front of the rear wheels shall be amber. Reflectors mounted behind the rear wheels shall be red.

3M Diamond Grade DOT 988 approved reflectors may be used in lieu of Peterson #472.

### **REGISTRATION CARD HOLDER**

A vinyl type holder approximately four inches by five inches (4" x 5"), having a transparent front shall be securely mounted for use in displaying vehicle registration and insurance cards. This holder shall be riveted over the driver's window in an area approved by SCDOE,T.

### **RUST PROOFING**

Unless otherwise specified herein, all sheet metal and body frame parts (12 gauge or thinner) shall be made of mill applied zinc coated steel having a minimum of one half ounce (1/2 oz) and three quarter ounces (3/4 oz) of zinc per square foot

respectively. All body frame parts thicker than twelve (12) gauge shall be primed and coated using a rust inhibiting material. Prior to the application of a primer in preparation for painting, all metal shall be thoroughly cleaned and treated.

All bolts, nuts, screws, and washers used in the completion of body shall be stainless steel or thoroughly treated in an approved manner to prevent rusting. All screws within reach of seated children shall be Torx or Phillips head.

### **SAFETY BARRIERS**

Safety barriers shall be the same height as passenger seat backs. Materials used in safety barriers must be consistent with materials used in passenger seat backs.

### **SEAT AND SEAT BELT, DRIVER**

1. DRIVER'S SEAT - The driver's seat shall be air suspension type, high back design and shall be positioned with the centerline of the seat on the centerline of the steering wheel.

The seat back shall be of a one (1) piece construction and designed so as to minimize the potential for head and neck injuries in rear impacts, while providing minimum obstruction to the driver's view of the passenger area. The height of the seat back shall be sufficient to provide the specified protection for up to a ninety-fifth (95<sup>th</sup>) percentile adult male, as defined in FMVSS 208. The driver's seat cushion shall be of a semi bucket design.

The driver contact area of the seat back and seat cushion shall be covered in a stain and wear resistant type, fabric upholstery material. The remaining areas shall be covered using a heavy weight (minimum 42 ounces) vinyl upholstery material.

The driver's seat shall be adjustable fore and aft a minimum of six inches (6"), up and down a minimum of four (4) inches, and shall include a minimum of fifteen (15) degree tilt back adjustability. All adjustment controls shall be designed for finger type adjustments and shall not require the use of tools. There shall be a minimum of ten inches (10") clearance between the steering wheel and driver's seat back regardless of seat or wheel position.

2. DRIVER'S SEAT BELT - A Type 2 combination lap belt/shoulder harness shall be provided for the driver. This assembly shall incorporate an Emergency Locking Retractor (ELR) for the shoulder harness and lap belt and a single push button release mounted on the right side at seat level.

Shoulder harness shall incorporate an adjustable mechanism to eliminate chaffing of driver's neck. This mechanism shall accommodate drivers ranging in size from fiftieth (50<sup>th</sup>) percentile adult female to ninety-fifth (95<sup>th</sup>) percentile adult male. Installation shall require approval by the SCDOE,T.

Installation of this belt shall be accomplished by use of a metal bracket to move the belt closer to the seat cushion and improve driver accessibility to the belt ends. The right side of the belt shall be guided or anchored at the seat frame, using a metal loop or similar device, so as to prevent the driver from sliding sideways off the seat.

### **SEATS, PASSENGER**

Seats shall be forward facing, shall be thirty-nine inches (39") wide and a minimum of fifteen inches (15") deep and shall be arranged in rows of two (2). Knee room for all seating shall be not less than twenty-five inches (25") when measured on the centerline of the seat at cushion height. Padded seat back shall be twenty-four inches (24") high measured at the seating reference point.

1. SEAT BACK – All seat foam shall have a listing type covering cemented to the front, back, top, sides, and over all glued seams of the seat back pad to hold foam in place.
2. SEAT CUSHION - The seat cushions must have a minimum base of fifteen thirty seconds inch (15/32"), four (4) ply, CDX plywood, or approved equal, and be fastened securely to the frame at not fewer than four (4) fixed points. If pivoting type latch is used, screws must be installed to prevent pivoting.
3. SEAT FRAME – Seat frames shall incorporate a solid wood or plywood tack strip (minimum 1 inch in width and full length) at attaching point for seat covers to allow for stapling. Seat back panels shall be constructed of full width plywood (minimum 11/32") or sheet steel (minimum 24 gauge) having sufficient strength to prevent breakage and or tearing of panels under normal use.
4. UPHOLSTERY FABRIC - All passenger seats backs, seat cushions and safety barriers shall be fully covered (no exposed wood) with a brown fire block material. It shall comply with the following specifications:
  - Mfg.: Athol, Kevlar Mfg., or Spradling
  - Brand: Proform or equivalent
  - Weight of Film: 38-oz linear yd.
  - Finish Weight of Material: 25-oz/sq. yd.
  - Product Specifications/Testing:
    - Grab tensile (lbs.) ASTM-D751
    - Tongue tear (lbs.) Fed 191A-51334
    - Tack tear (lbs.) ASTM D751-79 mod.
    - Trapezoid tear (lbs.) ASTM D1117
    - Adhesion (lbs./in.) ASTM D751
    - Seam breakage - AMC method
    - Flex testing (1 hr.) CFFA-10
    - Blocking-Fed Standard 191-5872
    - Low temperature (-20) #5 roller Fed STD 191A-5872
    - Abrasion (Wyzenbeek) Fed standard 191A-5304 240 grit-1000
    - Puncture Test 28 lbs.

Flammability Testing:  
FMVSS - 302  
FAR 25.853  
Boston bag  
National School Bus Standards fire block material

All upholstery material shall be installed in such a manner as to fit snugly, eliminate wrinkles and provide a smooth appearance. Material shall be stapled a minimum of once every four (4) inches.

### **SERIAL NUMBER PLATE**

Metal plate or decal shall be installed in the bus body on the left front header panel. A clear protective laminate must be installed over all decals. Letters and numbers on plate shall be permanently marked, legible and of minimum size 10 font.

The information that must be displayed shall include: Manufacturer's Name, VIN, Maximum GVWR, and Manufacturing Completion Date.

Any of the requested information that can not be provided on the manufacturer's serial number plate, shall be permanently displayed on a metal plate or decal located adjacent to the serial number plate.

### **SHOCK ABSORBERS**

The chassis shall be equipped with heavy-duty, double-acting hydraulic front and rear shock absorbers compatible with rated axle capacity. The shocks shall be mounted to a bracket affixed to the frame with rivets or minimum of grade eight bolts.

### **STEERING**

All chassis shall be equipped with power steering of the integral type and gear driven hydraulic pump. If the hydraulic pump supplies pressure to components other than the steering gear, a priority valve shall be installed giving priority to steering over other components.

All plumbing from the power steering pump to the steering gear box shall have a minimum recommended working pressure of three thousand pounds per square inch (3,000 PSI).

Steering wheel shall be a minimum of eighteen inches (18") in diameter and shall have a minimum clearance of three inches (3") from the instrument panel, windshield or any other surface.

Steering column shall be equipped with tilt function and shall provide for easy adjustment. If these functions are not hand actuated, the controls must be positioned to alleviate accidental operation. Any u-joint needing lubrication used in the steering shaft, must be able to be lubricated using normal lubrication equipment, and shall be accessible without removing any panels.

**STOP ARM AND CROSSING CONTROL ARM**

Stop arm and crossing control arm shall be installed to automatically activate in conjunction with the red flasher lights. The air source for stop arm and crossing control arm activation shall be the accessory supply reservoir. A pressure protection valve shall protect this air supply. Control valves used for regulating air pressure, for the stop arms and crossing control arms shall be mounted behind electrical access door/panel and shall be equipped with a locking feature on the adjusting knob.

1. STOP ARM - All buses shall be equipped with a stop signal arm that is air operated and equipped with a wind deflector. The word "STOP" shall be applied in white, six inch (6") letters on a red reflectorized background. Lighting shall be red, alternately flashing, strobe type LED.
2. CROSSING CONTROL ARM - All buses shall be equipped with an air operated crossing control arm. The crossing control arm shall be mounted on the front bumper and hinged on the right side of the bus.

**STORAGE, DRIVER**

A storage compartment located over the driver's side window shall be provided. This compartment shall have a bottom base plate of metal and shall be lockable. Key shall not be CH 545.

**SUN VISOR**

One (1), sun visor (Tiger 1522 or approved equal) shall be mounted so as not to interfere with the opening and closing of overhead storage compartments. Visor must be easily adjustable by driver and must have all corners rounded.

**SUSPENSION, FRONT**

Front suspension shall be spring type with a minimum per spring rating at ground of five thousand (5,000) pounds. Hanger brackets shall be secured to frame with a minimum of grade eight bolts.

**SUSPENSION, REAR**

Rear suspension shall be air ride type and shall have a rating equivalent to the axle capacity. A single, load sensitive, self-leveling control valve shall be incorporated to maintain constant ride height. This valve shall be adjustable and shall be installed on the centerline of the bus.

Ride Height Dimension shall be defined as the distance from the centerline of the rear axle to the bottom of the frame rail when the bus is in an unloaded condition. All hanger/mounting brackets shall be fastened to frame with a minimum of grade eight bolts. A load distributing plate shall be provided at the attachment points for the torsion control arm.

**TIRES AND WHEELS/RIMS**



All chassis shall be equipped with six (6) tires conforming to the following table. All tires shall be of the same manufacturer, size, and load rating.

***Tire Sizes***

<b>Manufacturer</b>	<b>Type</b>	<b>Size</b>	<b>Load Range</b>
Goodyear	G395	295/75R x 22.5	G
Michelin	XZE	275/80R x 22.5	G
Bridgestone	R299	295/75R x 22.5	G

All chassis shall be equipped with two (2) front and four (4) rear, ten (10) hole disc wheels (Accuride 8.25 x 22.5 or approved equal). Wheels shall be hub pilot type with five (5) hand holes. All wheels shall be fully painted with a hardened epoxy type paint to provide a uniform color.

All tires/rim assemblies shall be dynamically balanced. Any tire not balance correctable with less than twenty (20) ounces of weight shall be replaced. All tires shall be evaluated during pre-delivery service road test. Any tire deemed out of balance during road test shall be corrected.

One (1) spare tire and rim assembly (same as provided on the chassis) shall be provided for each bus. The tire and rim assemblies shall be mounted, inflated, and ready for use when delivered.

## **TRANSMISSION**

The transmission shall be fully automatic, electronically controlled and have a minimum of five (5) forward ratios, neutral, and reverse (Allison PTS 2500 series). The transmission shall incorporate an integral type filter that is externally accessible without removal of the transmission oil pan. The transmission assembly must be installed so that it can be removed for service without cutting of cross members.

## **VENTILATOR**

A static type roof exhaust ventilator shall be installed over the center aisle at a point approximately five feet (5') from the rear of the bus. The interior opening of the ventilator shall have a wire mesh cover. The ventilator shall be designed to provide full protection from rain and to exhaust air from within the bus body. This ventilator shall be of sufficient capacity to maintain the proper quantity of air flow under operating conditions without opening windows except in extremely warm weather.

## **WEIGHT DISTRIBUTION**

The weight distribution of a fully loaded bus on level surface shall provide approximately seventy percent (70%) of gross vehicle weight on the rear tires and approximately forty percent (40%) on the front tires.

## **WHEELHOUSINGS**

Wheelhouse opening shall allow for easy tire removal and service. Replaceable wheelhouse molding is required. Replaceable formed rubber wheelhouse extension shall be mounted around rear wheelhouse openings.

Wheelhousing shall be at least sixteen (16) gauge or heavier, designed to support seat and passenger loads and shall be secured to the floor sheets in such a manner to prevent dust or water from entering the body. All seams between the wheelhousing and body side panels shall be sealed. Inside height of wheelhousing above floor line shall not exceed ten inches (10").

## **WINDOWS**

1. **SIDE WINDOWS** - A split sash window shall be provided on each side of bus between each two (2) frame pillars. Top sash shall be controlled by finger operated controls. When in the open position, these windows shall provide a minimum unobstructed opening of twelve inches by twenty-two inches (12 " x 22"). A suitable visor, drip rail or similar water shedding device shall be provided for each window.

Window latches shall be designed to minimize projection type injuries and to insure against the inadvertent opening of windows when traveling on unpaved or uneven surfaces. Window latches and sliding mechanisms shall be repairable and/or rebuildable without disassembling the window frame or removing window from bus body. Individual latches or repair parts must be available and part numbers included in the published parts catalog.

2. **DRIVER'S WINDOW** - A sliding type window shall be provided at the left of the driver, which can be conveniently operated from the driver's seat. The window shall be provided with an approved sash and locking control and shall afford an opening of sufficient size to provide adequate driver visibility. The lower window channel shall have a self-draining feature to prevent the collection of water and prevent internal leakage.
3. **REAR WINDOWS** - If non-opening windows are provided on the rear of the bus, they shall be located on each side of the emergency door, shall be uniform in size and shall be of a flat glass design. These windows shall be properly lined up with the rear glass and with the side windows.

## **WINDSHIELD WIPERS AND WASHERS**

1. **WINDSHIELD WIPERS** - The body shall be equipped with heavy duty, two (2) speed with intermittent function, electric windshield wipers. Wiper motor shall be easily accessible for maintenance and repair. A single switch shall control the wiper motor(s).
2. **WINDSHIELD WASHERS** - The body shall be equipped with an electrically operated windshield washer system. The nozzles for this system shall be mounted on the windshield wiper arm. The windshield washer fluid reservoir shall be constructed of rigid plastic and have a minimum capacity of two (2) quarts. This reservoir shall be mounted in a position that is easily accessible for refilling.

**WIRING**

Multiplexing/Electronic system control technology shall be acceptable in lieu of circuit breakers, specified circuits and/or other electronic controls.

All wires shall be supported and secured at intervals not to exceed eighteen inches (18"), except that wiring located across the window headers shall be supported at each roof bow and shall be insulated and protected by a covering of plastic loom or approved equivalent. At any point where the wiring must pass through metal members, the edges must be de-burred and bushed with approved rubber grommets. All body wiring shall be fully concealed, protected, and enclosed in a removable cover extending from front to rear of body.

All electrical terminals and/or splices shall be joined to the wiring by means of machine crimp, ratchet crimp, or hand crimp and soldering. All terminal to wire connections must be made using sealed connectors or terminals with sealed heat shrink tubing. All wiring connections at junction blocks, terminal strips, and/or bus bars shall be made using stud and nut type junction blocks.

All chassis shall be wired so that the only current draw allowable, when the ignition switch is in the off position is from the brake lights, hazard lights, and horns. Electronic components (example: voltage regulator) having constant current draw of less than 30 milli-amperes are excluded from this requirement. A manually resettable circuit breaker (minimum 150 amp) located in the electrical access panel shall be provided to protect all body feeds.

1. CIRCUITS - Wiring shall be arranged in protected circuits that are properly labeled. Automatic or manual resetting circuit breakers of the appropriate amperage shall be used in circuits 5 amps and greater. Fuses may be used in circuits of 5 amps or less.
2. CIRCUIT IDENTIFICATION – All circuits shall be identified by a minimum of two (2) separate methods, which shall be any combination of circuit number, circuit color, or circuit name. Circuit identification letters or numbers shall be printed on the wire not less than every eight inches (8").
  - a. Circuit number shall be those used by the individual vehicle manufacturer or harness manufacturer.
  - b. Circuit colors shall be those specified by SAE standards or the 2005 National School Transportation Specifications and Procedures
  - c. Circuit name identification shall be standard nomenclature or abbreviations.
3. CONTROL PANEL - A control panel for heater, warning light, wiper switches, etceteras shall be located below the driver's window. The positioning of all switches/controls shall provide for easy driver access and identification. Switches with similar functions shall be grouped.

A "Noise Suppression Switch" identified by contrasting color, shall be provided within easy access of the driver and shall be wired to interrupt the operation of all noise producing accessories (blowers, fans, etceteras).

A 12-volt accessory outlet shall be located in an area that is accessible to the driver to facilitate cellular phone installation. Outlet must be equipped with an attached plastic cover.

A 12-volt power supply wire minimum 14 gauge, shall be routed, terminated, and capped at the driver's storage compartment and properly labeled. This power supply will be used for future installation of radios

Dual power supply wires (ignition feed and constant 12 volt), minimum 14 gauge, shall be routed, terminated, and capped at the control panel/electrical access panel and properly labeled. This power supply will be used for future installation of cameras.

A wiring bundle to accommodate the installation of GPS systems shall be provided. This bundle shall at a minimum include feeds for 12 volt power supply, stop arm operation, engine speed, engine temperature, engine oil pressure, and brake (service & park) application.

4. RELAYS - There shall be provided a minimum of two (2) (minimum 100 amp) constant service, heavy duty master relays, which are to be actuated by the ignition switch and through which all electrical accessories except the turn signal units are to be wired.

Wiring from the chassis to the relays and from the relays to the fuse block shall be a minimum of four (4) gauge wire. One (1) master relay shall supply current for the lights, stop arm lights, and Child Safety Alarm. The other master relay shall supply current for all noise producing devices such as heaters and fans.

**OPTIONS**

1. AIR CONDITIONING - Cost to provide interior air conditioning system (free blow) meeting specifications found in Appendix?
2. ALTERNATOR - Cost to provide 200-amp brushless alternator in lieu of 160-amp unit?
3. FUEL TANK, 100 GALLON - Cost to provide a 100 gallon fuel tank meeting all other fuel tank specifications on sixty five (65) passenger body?
4. LETTERING - Cost to provide lettering on the sides of the bus to read "South Carolina School for the Deaf and the Blind"?
5. LETTERING - Cost to provide lettering to reflect school district name or number?
6. LOCKS, KEYED VANDAL - Cost to provide complete body keyed vandal locks for all entrance/exits accessible from the ground?
7. MULTI-FUNCTION SCHOOL ACTIVITY BUS - Deduct to delete, Child Safety Alarm, Crossing Gate, Stop Arm, School Bus lettering, and Flashing Signal Lamps?
8. MIRRORS, EXTERIOR - Cost to provide heated exterior side view mirrors?
9. MIRRORS, EXTERIOR - Cost to provide remote controlled exterior side view mirrors?
10. PANELS, ACOUSTICAL ROOF - Cost to provide acoustical roof panels full body front to rear on sixty five (65) passenger body?
11. PANELS, ACOUSTICAL ROOF - Cost to provide acoustical roof panels full body front to rear on seventy one (71) passenger body?
12. PLYWOOD FLOORING - Cost to provide full body plywood flooring minimum thickness 5/8 inch CDX on sixty five (65) passenger body?
13. PLYWOOD FLOORING - Cost to provide full body plywood flooring minimum thickness 5/8 inch CDX on seventy one (71) passenger body?
14. PUBLIC ADDRESS SYSTEM - Cost to provide a public address system with interior and exterior speakers. No internal speakers, other than the driver's communication system, may be installed within five feet of the driver's seat back in its rearmost position. The driver's communication system (microphone and controls) shall be installed within easy reach of the driver while seated in the driver's seat, but shall not be easily accessible to passengers?

15. RESTRAINING BELTS - Cost to provide manually adjustable restraining belts as specified for each passenger position on sixty five (65) passenger body?
16. RESTRAINING BELTS - Cost to provide manually adjustable restraining belts as specified for each passenger position on seventy one (71) passenger body?
17. SEATING, PASSENGER – Cost to provide KEVLAR seat covering material for sixty five (65) passenger body?
18. SEATING, PASSENGER – Cost to provide KEVLAR seat covering material seventy one (71) passenger body?
19. SPARE TIRE CARRIER - Cost to provide underbody spare tire carrier with attached mechanism for lowering tire/wheel assembly to ground and access door. This option shall also include necessary jack and lug wrenches for changing tire?
20. STEREO - AM/FM W/ PA - Cost to provide AM/FM/CD stereo system with PA and a minimum of six (6) speakers. No speaker to be located within five feet (5') of the driver's compartment?
21. STORAGE COMPARTMENT - Cost to provide a single outside storage compartment located under the floor, in the body skirt, and in front of the right rear wheels having an approximate size of 13" high, 15" deep, and 25" wide. Compartment shall be dustproof and watertight with door?
22. STORAGE, UNDERNEATH LOCKABLE - Cost to provide full length, underbody luggage storage compartments. These compartments shall be key lockable and shall be sealed to be dust proof and watertight?

***2007***

***Type D***

***Specifications***

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***Type D***

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**AIR CLEANER**

Each engine shall be equipped with a heavy-duty, dry type, replaceable cartridge air cleaner. The air cleaner shall be mounted so as to allow for servicing and/or replacing the element without removing or loosening the housing. A constant reading, re-settable air restriction gauge shall be permanently mounted in the system.

**AISLE**

There shall be a minimum of twelve inches (12") of unobstructed aisle to the emergency doors.

**ALARMS**

4. BACK-UP ALARM - An audible back-up alarm shall be mounted within three feet (3') of the rear of the bus and between the frame rails. Alarm shall face rearward, shall be protected from debris and shall be capable of producing at least one hundred twelve decibels (112 db).
5. CHILD SAFETY ALARM - An audible warning alarm (Transportation Safety Products, Child Safety Alarm or approved equal) shall be located near the right front corner of the bus and incorporated into the warning light system to sound as the stop arm and crossing gate close. This system shall be wired to allow the red Flasher Lights to continue flashing until the alarm completes its cycle.
6. WALK THROUGH ALARM- Bus shall be equipped with a driver "Walk Through Alarm" meeting the following specifications.

Alarm will not arm itself until the warning light/stop arm system has fully cycled. Once armed and the ignition switch is turned off;

- d. the interior lights shall turn on and remain on for sixty (60) seconds after the system has been deactivated.
- e. the driver must disarm the system by depressing a button/switch that is positioned on the header above the left rear window.
- f. if the entrance door is opened prior to disarming the system, the horn shall intermittently sound at approximate one (1) second intervals.

**ALTERNATOR**

The electric power source shall be a heavy-duty bus/truck type alternator manufactured in the USA. This alternator shall produce a minimum one hundred sixty (160) ampere output and a maximum cold continuous draw of ten (10) milliamperes. The alternator shall be mounted on the upper portion of the engine. If alternator is located within eight inches (8") of the turbo, a heat shield must be installed to direct heat away from the alternator.

Alternator shall produce a minimum of sixty percent (60%) of its maximum rated output at the normal recommended engine idle speed. Supply lead from alternator

shall be sized so as to provide at least a twenty five percent (25%) greater current carrying capacity than the designed output of the alternator (minimum 2 gauge). All alternator wiring shall be routed so as not to cross over the engine valve cover.

Alternator shall be driven by a micro-v belt (minimum six (6) groove) equipped with a spring loaded, automatic tensioning device.

## **AXLES**

Axle ratings, front springs, and frame rails shall be compatible in load rating requirements. The manufacturer shall be responsible for providing axle weight ratings necessary to meet school bus certification.

6. FRONT AXLE - The front axle shall be of a heavy duty, truck type with a capacity rating of not less than thirteen thousand two hundred (13,200) pounds and having a minimum king pin diameter of 1.79 inches).
7. FRONT AXLE BEARINGS - Front axle bearings shall be self-lubricating, wet type with a two (2) piece grease seal. Axle hubs shall have threaded type fill port, shall provide for visible fluid level check, and shall be filled with 75W-90 synthetic lubricant.
8. FRONT AXLE ALIGNMENT - Front axle alignment specifications for toe-in and turn radius shall be verified during pre-delivery inspections and shall be warranted for a minimum of ninety (90) days. All other adjustments and/or components affecting steering geometry shall be covered for full warranty period.
9. REAR AXLE - The rear axle shall be heavy-duty, truck type with a minimum rating of twenty three thousand (23,000) pounds. When in operation, the rear axle gears shall provide a noise level not to exceed eighty five decibels (85 db) when measured at ear level of any seated passenger.

Axle shall be equipped with a magnetic fill plug, magnetic drain plug, and shall be filled with 75W-90 synthetic lubricant. A tag shall be placed on the rear axle hosing indicating synthetic lubricant. Rear axle grease seals shall be two (2) piece design.

10. REAR AXLE RATIO - Rear axle ratio to be determined by chassis manufacturer with concurrence from the manufacturers of the engine, transmission, and rear axle for optimum operating conditions (fuel consumption and power/torque curves), at 45 MPH and achieving a top speed of approximately 60 MPH. Final approval of axle ratios shall be given by the SCDOE,T.

**BATTERIES**

All chassis shall come equipped with a minimum of two (2) group thirty one (31), twelve volt (12v), maintenance free, commercial duty, stud-type, batteries connected in parallel. All battery cables shall be appropriately sized (minimum 000) with ring tongue lugs. The cable/lug junction shall be sealed. Individual cables shall be used to connect the batteries.

Each battery shall be of the same manufacturer and design with a minimum capacity rating of nine hundred twenty five Cold Cranking Amps (925 CCA) at zero degrees Fahrenheit with one hundred eighty (180 ) minute reserve capacity at 80 degrees Fahrenheit.

Batteries furnished by the OEM, must be available for replacement and shall be fully warranted for a minimum of twenty-four (24) months.

**BATTERY COMPARTMENT**

All batteries shall be located in an enclosed compartment and mounted under the body floor. This compartment must be equipped with a roll out tray that is sized to accommodate easy replacement of batteries and shall be retained in a retracted position by an approved latching device.

Battery hold downs shall be provided and designed to securely retain group thirty one (BCI 31) batteries in the mounted position without chaffing of cables or possibility of contacting terminals. These hold downs shall be secured to the battery tray by a minimum of two (2) bolts, washers, and nylock type nuts.

**BODY CONSTRUCTION**

Body must be tested and certified as complying with the standards for side intrusion tests and racking tests as outlined in the appendix. A copy of side intrusion and racking certification MUST be attached to the bid package. All buses are to be fully water tested.

5. GUARD RAILS – A minimum of four (4) replaceable guard rails shall be provided on the outside of the body on each side. The rails shall be installed over the paneling and shall run the full length of the bus except for any required openings. Pressed in guard rails are not acceptable.

The guard rails shall be approximately four inches (4") in width, formed from not less than sixteen (16) gauge sheet steel and shall be securely attached to the pillars and panels. The inside of all guard rails shall be vented and primed to prevent rusting.

Approximate location of the guard rails shall be as follows:

- a) One (1) located at bottom edge of window line,
- b) One (1) located at the seat line and extending from the service door around the rear of the body to the left windshield post (except for emergency doors),

- c) One (1) located at the floor line, and
  - d) One (1) located at the bottom of the outer panels that is supported by gussets or roof bows equal in strength to the post section.
6. **SIDE SKIRT - School bus body side skirts between the front and rear axles shall extend downward to the horizontal line from the center of the front spindle to the center of the rear axle. This measurement shall apply to a new unloaded school bus located on a flat level surface.**
7. **STEPWELL - A stepwell having not fewer than three (3) steps shall be built into the right front assembly, completely enclosed with doors extending to bottom step. Step height shall be measured with ride height set to it's proper adjustment. The distance between the steps shall be equal. Stepwell shall be constructed from not less than fourteen (14) gauge galvanized steel, fourteen (14) gauge Galvalume or sixteen (16) gauge stainless steel. Bracing shall be provided across the full width of the bottom step and shall be securely fastened to provide maximum strength.**
4. **STEPWELL SKID PLATE - A skid plate constructed from a minimum of one quarter inch (1/4") steel plate shall be provided and shall be of sufficient length and width to cover and protect the front and bottom area of the lower step. When installed this plate shall extend from the right front corner of the bumper down to and under the stepwell.**
5. **WINDOWS - All windows shall have visors or drip moldings at the top and when installed shall provide ample protection from leakage when operating in rain. A shedding device shall be provided to divert water from drip moldings away from the service door area. This device shall not interfere with the minimum required window opening.**

## **BRAKES**

All chassis shall be equipped with four wheel/channel ABS air brakes, having a dash mounted system indicator light. System shall have self-contained means for diagnosing system failures.

Rear axle brake actuators shall be designed and mounted on forward side of axle. The S-cam application and forward wheel rotation shall be in the same direction. All air brake system component groups and part numbers shall be of the same manufacturer(s) for the total order.

### ***Minimum Brake Sizes***

<b>Axle</b>	<b>Brake Lining</b>	<b>Air Chambers</b>	<b>Slack Adjusters</b>
Front	16.5" x 6.0"	24"	Haldex
Rear	16.5" x 8.0"	30"	Haldex

10. AIR COMPRESSOR - Bendix or Wabco with a minimum supply rating of 13.2 CFM shall be provided on all engines. The compressor shall be installed so as to provide air induction for the compressor from the clean-air side of the engine air cleaner. Coolant supply hoses if required, for the compressor shall be Type B, Class 2, level A, grade 1 hose. All hoses one inch (1") and larger shall be secured with stainless steel, constant torque, worm gear drive type clamps.
11. AIR DRYER - Bendix AD-9 or AD-IP air dryer shall be installed on all air brake systems. The dryer shall be equipped with a functional internal heater and automatic exhaust valve. The dryer shall be securely mounted on the frame rails or cross members and shall not extend downward more than seventeen inches (17") as measured from the top of the frame rail. The location of the dryer shall be such that the assembly is easily accessible for service and maintenance.

All plumbing from air compressor to input of air dryer shall be routed for direct entry into air dryer utilizing soft flow bends and eliminating all sumps in the air lines.

12. AIR SUPPLY LINES - All air supply lines shall be color-coded tubing as indicated below. These lines shall not be painted or sprayed with undercoating so as to obscure color-coding. Any temporary coverings used to protect the air lines from paint or undercoating shall be removed prior to delivery of vehicle.
13. AIR SUPPLY RESERVOIRS - A minimum of three (3) separate air reservoirs (wet tank, primary tank, and secondary tank) shall be provided for the braking system and shall be sized to provide a capacity that is at least ten percent (10%) greater than the capacity required by FMVSS 121.

The wet reservoir shall be equipped with automatic moisture ejection valve and the primary and secondary reservoirs shall be equipped with manual drain valves (petcocks). No portion of the reservoir tanks and/or attached valves or fittings shall be positioned above the chassis frame rails.

14. BRAKE CHAMBERS - All brake chambers shall be long stroke design and shall conform to sizes specified in table. All spring brake air chambers shall have a means for manually caging springs and manual caging device shall be suitably attached to the chambers.
15. BRAKE DRUMS - All brake drums shall be outboard mounted to facilitate brake maintenance without disturbing wheel bearings and seals
16. BRAKE LINING - All lining for air brake systems shall be constructed of asbestos-free, extended service type material complying with the minimum sizes listed in the table.

17. **PARKING CONTROL VALVE** - The park brake control valve shall be located on the right of the driver and shall be clearly marked (yellow). The operation of this valve shall be convenient to the driver when in a normal seated position.

The parking brake system shall be designed to function as follows, after the parking brakes are applied and the ignition switch is turned to the "OFF" position, the release of the brakes shall require:

- a) Releasing the Parking Brake Control knob,
- b) Turning the ignition switch to the "ON" position, and
- c) Depressing the service brake pedal.

This shall be accomplished by controlling the flow of air to the system and not by placing a blocking device on the park brake control knob.

18. **SLACK ADJUSTERS** - Slack adjusters shall be Haldex self-adjusting with external grease fittings. Grease fittings shall be positioned so as to be convenient for servicing.

## **BUMPER**

All buses shall be equipped with heavy-duty, one-piece front and rear bumpers constructed from a minimum of three sixteenths inch (3/16") thick pressed channel steel. Openings in the front bumper for accessing tow hooks may be provided but must be no larger in size than is required to access hooks.

All bumpers shall extend to the outer edge of the bus body at bumper top-line. Any rear bumper not fitting within one-quarter inch (1/4") of body panels must have a securely fastened rubber or metal strip to eliminate gap.

All bumpers and bumper brackets shall be securely bolted to the ends of the frame rails and/or frame brackets and side members. Bumper construction and mounting shall be of sufficient strength to support the weight of the bus (as in lifting with a jack positioned near frame end attachment points) without requiring readjustment or causing permanent distortion to the bumper, chassis, or body.

## **CAPACITY**

Capacity will be based on a minimum of twenty-seven inch (27") forward facing seat centers (measured at seat level), overall width of at least ninety-six inches (96"), center aisle width of twelve inches (12"), and thirty-nine inch (39") seats.

***Minimum Bus Capacities***

<b>Capacity</b>	<b>35 Passenger</b>	<b>66 Passenger</b>	<b>78 Passenger</b>
<b>Wheelbase</b>	180" - 222"	180" - 222"	235" - 250"

## **DOORS**

4. BATTERY COMPARTMENT DOOR - Battery compartment shall be accessible through a door located in the side skirt and hinged toward the front. This door shall be furnished with a flush mounted, adjustable, key-locking, metal latch (key number CH 545).
5. ELECTRICAL PANEL ACCESS DOOR - A weatherproof access door shall be provided on the left front corner of the body for servicing and repairing electrical components and wiring. This door shall be hinged to the front and will be furnished with a flush mounted push button activated, adjustable, key-locking, die-cast metal latch with black matte finish (key number CH 545).

A weatherproof wiring schematic (body and chassis) shall be permanently attached to the inside of the door. This schematic shall be applicable to the bus and identification of the circuits shall be consistent with the vehicle harness.

6. ENGINE ACCESS DOORS - Two (2) doors, one (1) located on each side of the bus shall be provided for access to the engine compartment, radiator, and accessories. These doors shall be hinged and sized to provide adequate working clearance and shall be furnished with flush mounted push button activated, adjustable, die-cast metal latches having a black matte finish. If these doors are covered by perforated steel mesh, the hole size in the mesh shall not exceed one and one half inch (1 1/2").
7. FUEL FILLER DOOR - A suitable door of not less than sixteen (16) gauge steel shall be installed over fuel filler opening on the right side of body. This door shall be spring-loaded and shall remain in a closed or open position. Door to be hinged toward the front and equipped with a keyed type lock (key number CH 545).

Buses equipped with wheel chair lift may have the fuel tank filler door located on the left side provided it can not be located on the right side.

4. SERVICE DOOR - Service door shall be air operated, outward opening and designed to prevent accidental openings. The door shall be located ahead of the front wheels on the right side of the bus and controlled by the driver.

Door control lever/switch shall be mounted in an approved location that is easily accessible to the driver. Electrical door switch shall not operate when ignition is not in "ON" position.

Door shall be equipped with an emergency release control located in or adjacent to the door header panel and designed to exhaust air supply from the operating mechanism. This control shall be clearly and permanently marked, including operating instructions. Door operating mechanism shall be fully adjustable, located overhead of door and concealed behind a removable access panel.



Door when fully opened shall provide a minimum clear entrance area of twenty-four inches (24") wide and seventy-six inches (76") high. A suitable drip molding or rail to shed water shall be located above the door.

A stainless steel assist rail (minimum 20" length) shall be installed on all units on the windshield side of the entrance stepwell. This rail shall be securely mounted and installed in such a manner as to afford easy accessibility to small children during bus entry and/or egress.

### **DRIVELINE**

Drive shafts shall be provided with adequate protective metal guards to prevent whipping through the floor or dropping to the ground in the event of shaft breakage. All drive shafts shall be properly phased and balanced to eliminate vibrations.

### **EMERGENCY EQUIPMENT**

All emergency equipment shall be securely mounted in the driver's area. The overhead compartment will be utilized for all items except the Seat Belt Cutter and Fire Extinguisher. This compartment shall be of sufficient size to allow storage and easy removal of all emergency equipment.

This compartment shall be finished on the inside and shall allow for mounting the first aid kit and body fluid kit in an upright position. This compartment shall be boxed on the ends to prevent objects from sliding and/or falling to the left or right of the opening.

This compartment shall be covered by a door appropriately lettered, hinged at the top, and adequately secured (non-locking). The compartment shall provide a device for retaining the door in an open position during inspection or removal of emergency equipment.

6. BODY FLUID CLEAN-UP KIT - All buses shall be equipped with a removable, moisture proof and dust proof body fluid clean-up kit meeting the requirements of the 2005 National School Transportation Specifications and Procedures.
7. FIRE EXTINGUISHER - All buses shall be equipped with a dry chemical, compressed air type fire extinguisher bearing Under Writer's Laboratories, Inc. rating of not less than 2A-10BC (5 lbs). The extinguisher shall be equipped with a pressure gauge and a flexible rubber hose.

The fire extinguisher shall be securely mounted in an area approved by the SCDOE,T. Mounting must allow reading the pressure gauge without removing the extinguisher from the bracket.

8. FIRST AID KIT - All buses shall be equipped with a removable, moisture proof and dust proof first aid kit meeting the requirements of the 2005 National School Transportation Specifications and Procedures.
9. SEAT BELT CUTTER - A seat belt cutter shall be provided on all buses and shall be mounted in an area that will provide easy access to the driver while in a seated position. This cutter shall incorporate replaceable, stainless steel blades and shall be designed to eliminate the possibility of the operator or others being cut during use. (Tie Tech Safecut or approved equal).
10. WARNING DEVICES - All buses shall be equipped with three (3) reflectorized triangles, road-warning devices. These devices must meet FMVSS 125 requirements, shall be secured in a box and the box shall be secured in the compartment.

### **EMERGENCY EXITS**

All emergency exits shall conform to FMVSS 217 and shall be appropriately marked with operating instructions.

4. EMERGENCY DOORS - There shall be an emergency door located on both the left and right sides of the bus (except 35 passenger, left door only). Exterior door handles shall be contoured to allow grasping and pulling the door open.

These doors shall have a self canceling, latching mechanism that holds the door in an open position to prevent it from closing during emergencies and evacuation drills. The door shall be reinforced to prevent bending when pushed against latching mechanism.

Side emergency doors shall be equipped with an upper glassed opening (minimum of 340 sq/in).

5. EMERGENCY PUSH OUT WINDOWS - All buses shall be equipped with push out windows that are hinged to the front with one half of the windows located on each side of the bus. Quantity shall be based on the table below. Positioning of these windows shall be staggered.
6. EMERGENCY WINDOW - Emergency window shall be located in the rear of the bus and shall be outward opening with a minimum clear opening area of at least nine hundred square inches (900 sq/in). Pneumatic struts shall be provided to assist opening.
7. EMERGENCY ROOF HATCHES - All buses shall be equipped with two (2) emergency roof hatches. These hatches must be equipped with a simple release mechanism that is operable from both inside and outside the bus (Specialty 9245 or Transpec 1970).

### ***Emergency Exit Requirements***

<b>Minimum Capacity</b>	<b>35 Passenger</b>	<b>66 Passenger</b>	<b>78 Passenger</b>
Emergency Doors	1	2	2
Push Out Windows	2	4	4
Roof Hatches	1	2	2

### **EMERGENCY EXIT BUZZERS**

3. **EMERGENCY DOORS** - The emergency door locks shall contain a switch activated by one quarter inch (1/4") travel of the lock to which is attached audible buzzers to alert the driver when the emergency door is not properly secured. There shall also be a buzzer/audible alarm with indicator located, in the driver's area to warn of an improperly secured emergency door.
4. **EMERGENCY WINDOW** - The emergency window shall be equipped with two (2) audible buzzers, one (1) located at the window and one (1) located in the driver's control panel. These buzzers shall sound only when the latch is moved toward an open position.
5. **OTHER EMERGENCY EXITS** - All other emergency exits will be equipped with the necessary switches, wiring, and buzzer or audible alarm with indicator located in the driver's area, so as to alert the driver when either of the latches for these items is moved toward a released position.

### **ENGINE**

The chassis shall be equipped with a heavy-duty, electronically controlled diesel engine. All engines must be unaltered current production models and shall meet all applicable Federal Regulations at the time of purchase. Electronic links between the engine and transmission shall interface to insure optimal operating efficiency. Easily accessible data access ports shall be provided.

All engines shall be equipped with an ignition switch operated electric shutdown. All buses purchased under a single order shall be keyed alike. A minimum of one (1) spare key shall be provided with each bus. Installation shall provide for technicians to access routine service/maintenance areas without hazard.

#### **Approved Engines**

<b>Manufacturer</b>	<b>Model</b>
Caterpillar	ACERT C7
Cummins	ISC
Navistar	MAXXFORCE DT
Mercedes	MBE 906

#### **Performance Requirements**

<b>Capacity</b>	<b>HP</b>	<b>Torque</b>
35 - 66 - 78	220	660

Turbo charger and water pump shall carry same warranty as engine. Turbo charger failure caused by lack of lubrication shall not be cause to void the warranty. All engines shall be equipped with a thermostatically controlled cooling fan. If the

cooling fan system is hydraulically driven, the system shall incorporate a remote mounted reservoir (with integral filter) and a cooler of sufficient capacity to allow for cooling of hydraulic oil before pumping back into the circuit.

Molded hoses shall be used in all applications requiring bends, turns, or angles (multi-ribbed flex hoses are not acceptable). All hoses shall be of Type B, Class 2, level A, grade 1 construction. All hoses one inch (1") and larger shall be secured with stainless steel, worm gear driven, constant torque clamps. Any unused, temporary plugs shall be converted to permanent plugs prior to delivery. All engine coolant shall utilize a 50/50 mixture (-34 F freeze/265 F boil over) of deionized water and extended life, inorganic acid type, antifreeze. Engines shall be equipped with corrosion resistant metal hose bibs for use in heating systems (minimum 1").

### **ENGINE COMPARTMENT**

Engine compartment shall be lined with painted steel meeting all rustproofing and painting requirements, embossed aluminized steel, or Galvalume (22 gauge minimum). All materials shall be capable of withstanding detergents and high pressure wash.

Engine compartment door(s) shall be hinged along the top edge if located on the rear of the bus or on the front edge if located on the side of the bus. Each door shall be furnished with two (2) flush mounted, adjustable, die-cast metal latches having a black matte finish.

Engine compartment door may be aluminum, but must be suitably framed incorporating full perimeter reinforcement and a minimum of one additional reinforcing member positioned across the width of the door. Exterior paneling shall be mechanically fastened or welded to the perimeter framing and reinforcing member(s). Pneumatic assisted spring supports shall be provided to assist in opening any horizontally hinged door and shall securely maintain the door in an open position. No screws or other sharp objects shall protrude into the engine servicing area. All wiring shall be securely fastened with looms and clips.

Ignition switch system shall be wired so that the engine starter can not be engaged from the dash if an engine compartment door is in an open position. A control panel shall be provided in the engine compartment and shall include:

- a) On/Off switch for illuminating lamps (wired so lamps will not operate if engine door(s) are in closed position).
- b) On/Off ignition switch
- c) Starter circuit requiring two handed operation
- d) Oil pressure gauge
- e) Water temp gauge
- f) Manually re-settable (minimum 150 amp) circuit breaker for all body feeds
- g) Diagnostic terminal ports for engine and transmission

### **EXHAUST SYSTEM**

The muffler and all exhaust system components shall be made of corrosion resisting material and shall carry the same warranty as the engine. Manufacturer must

insure that exhaust temperature during any loading/unloading activity with the engine running shall not be great enough to produce first, second, and/or third degree burns. The bus shall not automatically enter a regeneration cycle if vehicle speed is not greater than five (5) miles per hour. During the regeneration cycle the exhaust temperature when measured six inches from the exhaust tip shall not exceed six hundred degrees Fahrenheit (600F).

Each component of the exhaust system shall be securely attached utilizing heavy duty, vibration-absorbing type mounts. The muffler shall be securely mounted to the frame members at a minimum of two (2) points. Tail pipe shall be turned down at the tip and exit at the bottom edge of the rear bumper or exit through the rear bumper near the left rear corner. If tail pipe exits through rear bumper sufficient clamps/brackets shall be provided to eliminate rattles. No part of the exhaust system shall be located within the angle of departure and at no point shall any part of the system be positioned closer to the ground than the body side skirts.

### **FAN, ELECTRIC**

One, dual speed, six inch (6"), twelve-volt (12v) electric fan shall be provided for air circulation. This fan shall have a metal, corrosion resisting guard with metal blades and shall be individually switched (Baader Brown #0900-072-000 or approved equal). Location shall be near the center of the windshield, but shall not obscure visibility of the right side rear vision mirrors. Dash integrated forced air ventilation system is acceptable in lieu of electric fan.

### **FLOOR**

2. FLOOR COVERING - The floor covering shall be smooth, black/charcoal in color, and fire resistant. The flooring shall have a minimum overall thickness of one eighth inch (1/8") and a minimum dry static coefficient of friction of 0.6 as determined by ASTM D 1894-93.

The floor covering over openings shall be cut in sections to conform to any removable floor panels. The covering shall be removable with the panel without disturbing the flooring in the other areas. The adhesive for laminating floor covering to the floor shall be a water and fire resistant type.

The aisle and entrance platform area shall be covered with an aisle type, ribbed flooring having a minimum thickness of three-sixteenths inch (3/16").

All steps including top of nosing, shall be covered with raised pebble design material complying with the requirements of the 2005 National School Transportation Specifications and Procedures.

All joints in the floor covering area shall be sealed and covered with an approved one inch (1") wide, sixteen (16) gauge rust proof metal strip or molding. An additional cover molding shall be provided around the body wall at the floor line to lap over the floor covering. The molding may be a separate applied molding or it may be a part of the body panel but, in either

case, it shall fit snugly upon the floor covering so that dirt cannot readily work underneath the edges.

3. FLOOR PLATE - Floor plate shall be a minimum of fourteen (14) gauge prime commercial quality, zinc coated steel having not less than one and one quarter (1 ¼) ounces of zinc per square foot or fourteen (14) gauge Galvalume.

Floor plate not complying with specifications listed above, shall require a written warranty against failures due to corrosion for a minimum of fifteen (15) years. This warranty shall cover the full cost of repairs and shall be provided at the time of the Pilot Inspection.

All floor joints shall be gas tight to prevent the entrance of heat and fumes. Suitable openings shall be provided for servicing any chassis components such as fuel tank sender and fuel line connections. All openings in floor plate shall be sealed and covered by a metal plate.

## FRAME

All chassis frames shall be formed from full depth, "C" channel steel and shall comply with the specifications listed below.

### *Frame Rail Specifications*

<b>Yield Strength</b>	<b>Section Modulus (Min.)</b>	<b>RBM (Min.)</b>
50,000 psi	14.00 cu/in (nom)	700,000 in/lbs

Section modulus shall be nominal calculations based on the design dimensions of the frame rail. This shall include any sections that may have been modified during assembly. Any notched areas of a frame rail shall be reinforced utilizing frame liners sufficient in size and strength to insure compliance with the minimum section modulus requirements. There shall be no extra holes drilled in the frame rails.

1. FRAME RAILS, MAIN - The main frame rails shall be a continuous section from front of vehicle to aft of rear axle spring hangers.
2. FRAME RAILS, MODULAR - The modular frame rails shall be designed and constructed as a removable unit to facilitate drivetrain component maintenance, removal and servicing. This frame section shall provide for a minimum of thirty four inches (34") spacing between the nearest points of the frame rails and a minimum of five inches (5") clearance between the nearest point of the frame rails and attached engine components.

A minimum of five (5) cross members shall be provided and shall be formed from a minimum of three-sixteenths inch (3/16") steel. Cross member mounting flange shall be a minimum of ninety percent (90%) of the frame rail height. At least one fully boxed or "double dogbone" cross member shall be installed at a point approximately midway between the front and rear axles.

The frame and all attached components shall be thoroughly coated with paint or undercoating. Precautions shall be taken to insure that color coded items (air supply tubing, wiring, etceteras) are not painted.

Frame rails and/or cross-members not complying with all specifications listed above, shall require a written warranty covering all failures (excluding accident damage) for a minimum of fifteen (15) years. This warranty shall fully cover the cost of repairs necessitated by cracking, breaking, and/or bending and shall be provided at the time of the Pilot Inspection.

### **FUEL FILTER**

All engines shall be equipped with a primary fuel/water separator filter and a secondary fuel filter of the engine manufacturer's standard type. The fuel/water separator shall be designed for easy detection of water accumulation without removal of filter and shall be equipped with a built in drain valve.

### **FUEL TANK**

A one hundred (100) gallon, aluminized steel fuel tank shall be furnished on all chassis. Fuel tank vent shall be positioned so as to eliminate the possibility of fuel spillage when the bus is parked on uneven surfaces and shall have a hose installed that is routed toward the rear of the chassis. The fuel tank is to be located between the frame rails, between the axles and shall provide for best weight distribution.

The fuel tank neck must be metal, securely mounted and shall be equipped with a standard non-vented cap. The bus body floor shall include an access plate for servicing and/or removing the sending unit.

### **GLASS**

All glass shall be legibly and permanently marked and shall conform to the American Safety Code for Safety Glazing Materials. There shall be no unfinished, exposed glass edges.

3. WINDSHIELD - The windshield shall be polished plate glass, AS1. The windshield glass shall be shaded with heavy tint on the upper portion.
4. WINDOW AND DOOR GLASS - All window and door glass shall be laminated, minimum 7/32" thick. Glass used in entrance door and driver's side window shall be AS2. Glass used in passenger windows and emergency doors shall be tinted AS3 having twenty eight to thirty one percent (28% to 31%) light transmittance.

### **HEATER AND DEFROSTER**

Heater/defroster system shall be capable of maintaining bus interior temperature as specified in test procedure SAE J2233. The heat source for this system will be engine coolant. The front heater shall utilize a combination of fresh air

(approximately 60%) and re-circulated air. Any additional heaters may be re-circulating type.

2. BLOWERS - The heater system shall be equipped with a minimum of four (4) electric, two (2) speed, and motor driven blowers. The total air output of the heater blowers shall not be less than fifteen hundred cubic feet per minute (1500 CFM) when measured on high speed.

Air intake shall be sufficient to maintain all blowers at full force. When all blowers are operating at full speed; any noticeable reduction in air output for any blower motor will disqualify heating system.

The heater cover shall contain panels that are easily removable for access to heater motors without requiring the removal of a seat.

4. BOOSTER PUMP - To insure adequate coolant flow to the heater/defroster system, all heater systems shall be equipped with a heavy duty booster pump. This pump shall have a metal housing and shall be rated for a minimum of ten (10) GPM at three (3) PSI. A separate switch on the driver's control panel shall control the booster pump. Booster pump may be controlled by heater switches.
5. CORES - The heater cores shall be a heavy-duty coil type. The coil shall be high-pressure copper or aluminum tubes with aluminum plate type fins with self-spacing, die formed collars completely covering the tubes. Cores of the cellular type, not made of 100% brass or copper, will not be accepted.
10. DEFROSTER - The defroster installation shall provide sufficient airflow outlets to provide for defrosting/clearing the full length of the windshield. Additional outlets shall be provided; a minimum of one (1) each at the left and right sides, to allow for defrosting/clearing the driver's side window and entrance door glass. A suitable device shall be provided to preclude dropping foreign objects through the defroster outlets into defroster motor area.

Rubber or fabric defroster hose shall not be used for conducting the heated air from the defroster blower(s) to the defroster outlets. Temperature operating range for duct hose must be minus forty to one hundred sixty degrees Fahrenheit (-40F to 160F).

11. FRESH AIR INLET - The fresh air inlet shall provide a slight super charging or pressurizing effect when the bus is in motion. This inlet shall be located and designed to prevent dust and dirt from entering through the system. If a filter is installed, it must be re-useable type that is easily removable for servicing.
12. HEATER(S), FRONT - The front heater arrangement shall supply heated air to the driver's compartment area and also toward the rear into the passenger area.



13. HEATER(S), REAR - Rear heater(s) shall be located under passenger seat in the rear one third (1/3) of the bus and shall not obscure foot room of passengers seated behind the heater. Heater unit will be protected so as to alleviate damage to the heater and components from passengers under normal operating conditions. All plumbing shall be secured and adequately protected. The heater housing and related components shall be insulated/protected to alleviate excessive surface temperatures.
14. PLUMBING - All coolant hoses used for heater supply and installation shall be of a Type B, Class 2, level A, grade 1. All hoses one inch (1") and larger shall be secured using stainless steel, constant torque worm gear driven type clamps. These hoses shall be adequately supported and protected to prevent body vibrations from being transmitted through the hoses to the heater core inlet and outlet nipples.

Brass or copper elbows shall be used where coolant hoses must turn or change direction sharply. A brass or copper tube assembly shall be provided at any point where the hoses must pass through the floor, body panels, and/or bulkhead. Plumbing at the emergency door area must not create a trip hazard.

All hoses routed on the inside of the bus shall be covered by approved panels and shall be secured at points not to exceed three feet (3') in distance. There shall be no exposed hoses in the interior compartment of the bus.

Any antifreeze added during heater installation must be compatible with that installed by the engine manufacturer. Coolant system inhibitors if utilized must be adjusted after installation of heater system.

15. SWITCHES/CONTROLS - All switches for control of the heater blower motors shall be grouped together. Separate switches shall be used to control individual blower motors.

Two (2) engine mounted water control valves, one quarter (1/4) turn, brass, ball type shall be installed; one (1) each on the coolant supply and return hoses for the heaters. An in-line bleeder screw assembly shall be provided near the valve on the return side.

One (1) corrosion resistant water control valve, one quarter (1/4) turn, brass, ball type or approved equal shall be controlled from the driver's area to allow closing off coolant flow to heaters on warm days. An electronic switch or remote mounted control conveniently located to the driver may be used to control this valve.

## **HORN**

All horn(s) shall be securely mounted and located away from the wheel splash area so as to prevent contamination from road spray.

**INSTRUMENTS AND INSTRUMENT PANEL**

The instrument panel shall be designed to eliminate glare on the gauges when operating the bus in bright sunlight. Integrated cup holders shall not be provided.

All instruments and gauges shall be mounted in such a manner that each is visible to the driver while in a normal seated position. The following instruments and gauges are required (lights in lieu of gauges are not acceptable):

15. AIR PRESSURE GAUGE(S) - Shall include warning light and buzzer to indicate low air pressure. Single gauge with two (2) needles of contrasting colors is acceptable.
16. COOLANT TEMPERATURE GAUGE - Shall include a warning light and buzzer to indicate high water temperature based on engine manufacturer's recommendation. Water temperature sensor shall be located on the engine.
17. ENGINE SERVICE LIGHT - A dash-mounted light shall be provided to indicate if the electronic engine control module detects a malfunction.
18. FUEL GAUGE
19. HIGH BEAM HEADLIGHT INDICATOR - Must have replaceable bulb or be LED lighted.
20. INSTRUCTIONS - Any special operating instructions for engine or transmission shall be displayed in an approved location on the dash panel.
21. LOW COOLANT WARNING - Shall include a warning light and buzzer to indicate low coolant levels in the de-aeration tank.
22. ODOMETER - Shall indicate a minimum of six (6) digits not including tenths (1/10) of a mile and shall be readable with ignition switch in the "OFF" position. Additionally, tenths (1/10) of a mile must be displayed on either the Odometer or Trip Odometer.
23. OIL PRESSURE GAUGE - Shall include a warning light and buzzer to indicate low oil pressure based on engine manufacturer's recommendation. If mechanical oil pressure gauge is provided, all inside plumbing shall utilize stainless steel braided hose.
24. SPEEDOMETER, ELECTRONIC
25. TACHOMETER/ENGINE HOURMETER - Hourmeter shall be wired to operate only when engine is running and shall be readable with ignition switch in the "OFF" position.
26. TRANSMISSION TEMPERATURE GAUGE

27. TURN SIGNAL INDICATORS, LEFT/RIGHT – Must have individually replaceable bulbs or be LED lighted.
28. VOLTMETER - Shall have a graduated scale capable of indicating up to sixteen volts (16v), shall indicate battery voltage, and shall be off when the ignition switch is in the off position.

Note: Warning light and buzzer for oil pressure, coolant temperature and low coolant may be combined.

### **INSULATION AND UNDERCOATING**

4. ENGINE COMPARTMENT - Rear engine compartment shall have a minimum of one inch (1") of thermal insulation having a minimum R-5.75 rating, sandwiched between the engine compartment panels and the interior body panels. Noise barrier insulation shall be provided to reduce interior engine noise level at the rear of the bus to a maximum of seventy eight decibels (78 db).

The recorded noise level shall be an average of four (4) readings taken at ear level of an adult male seated in the driver's seat and shall be taken with the vehicle stationary. The engine shall be operating at maximum rated revolutions per minute (RPM), all windows and doors closed, no large reflecting surfaces located within fifty feet (50') of the vehicle and the noise level meter set on the "A" scale.

5. ROOF/SIDES – The space between all interior and exterior body panels shall be insulated using a minimum of one and one half inches (1 1/2") of insulation having a minimum R-6 rating. This insulating material shall also be installed in all voids created by roof bows, body caps, etceteras.
6. UNDERCOATING - The entire underside of the bus; to include body and wheelhousings shall be coated to a minimum depth of one sixteenth inch (1/16") with high quality automotive type underseal to protect the body and chassis from rust and to seal and insulate the floor. Precautions shall be taken to insure that color coded items (air supply tubing, wiring, etceteras) are not coated.

### **INTERIOR**

The finished inside body height shall be a nominal seventy-six inches (76") minimum measured at any point on the longitudinal centerline from the front vertical bow to the rear vertical bow.

### **LAMPS AND DIRECTIONAL SIGNALS**

All lighting equipment shall be furnished to comply with the FMVSS 108 and the laws and regulations of the State of South Carolina. All LED (light emitting diode)

lamps shall have a hard shell coating to protect from chemicals and abrasion. The lighting equipment provided shall at a minimum include:

6. BACK-UP LAMPS - Dual, four inch (4"), LED back up lamps meeting SAE requirements shall be installed on rear of bus and activated by a switch on the transmission or transmission shift control.
7. CLEARANCE/MARKER LAMPS - Minimum of twelve (12) required; one (1) installed on each of the four (4) roof corners, two (2) clusters of three (3) mounted between the clearance marker lamps on the front and the rear of the bus at the roofline, and one (1) mounted on each side at the approximate centerline of bus. If lamps are not recessed they shall be armor type.

The lamps positioned from the center of the bus forward shall be amber in color. The lamps positioned on the rear of the bus shall be red in color. All lamps shall be LED with sealed electrical plugs. Clearance/marker lamps shall be controlled by the chassis headlight switch and wired to burn with chassis parking lights or headlights.

8. CONTROL PANEL ILLUMINATION - All switches/controls located on the driver's control panel shall be lighted for easy identification. This shall be performed in such a manner that will not create excessive glare for the driver. If switches/controls are self-illuminated, individually replaceable bulbs or LED's must be used.
9. DAYTIME RUNNING LIGHTS - All buses shall be equipped with DRL (low beam headlights) that are wired to automatically operate anytime that the engine is running. These lights shall not turn off by applying the parking brakes.
10. ELECTRICAL ACCESS PANEL LAMP - The electrical access panel shall be equipped with two (2) clear lens or approved equal, type lamps to provide illumination for technician. These lamps shall be controlled by a switch inside the panel and shall operate only if the panel door is open.
11. ENGINE COMPARTMENT LAMPS- Minimum of two (2) engine compartment illuminating lamps shall be provided. If the opening of the engine compartment door(s) reduces the visibility of the stop/tail lamps from the rear of the bus, two (2) additional stop/tail lamps shall be provided. These lamps shall be positioned so as to be fully visible with the engine compartment door(s) open.
12. SCHOOL BUS SIGNAL LAMPS - All buses shall be equipped with an alternately strobing School Bus Signal Lamp system. This system shall consist of four (4) red LED signal lamps and four (4) amber LED signal lamps. Each lamp shall provide a minimum of 38 sq/in of lighted surface area.

Lights shall be actuated by a heavy-duty momentary contact switch that is mounted to the driver's left near the front of the control panel.

Signal lamp system shall operate as follows:

- a) Right and left signal lamps shall strobe alternately.
  - b) The system shall be wired so that the amber signal lamps are activated only by hand operation.
  - c) With entrance door closed, activate momentary contact switch. Amber pilot light and amber signals shall go on.
  - d) The amber signal lamps will automatically be deactivated and the red signal lamps will automatically be activated when the bus service door is opened.
  - e) When the service door is closed the Child Safety Alarm will automatically be activated and the stop arm/crossing gate will automatically be deactivated. The red signal lamps shall remain on until the Child Safety Alarm has cycled.
  - f) A fail-safe/override switch (on/off) shall be installed to operate the red signal lamps, stop arm and crossing gate if other system fails. When this switch is activated the red pilot light, red signal lamps, stop arm, stop arm lamps, and crossing gate shall be turned on.
  - g) Two (2) pilot lamps, one (1) red and one (1) amber shall be positioned so as to be easily visible to the driver even in bright sunlight. These lamps shall operate when the respective amber or red flasher system is activated.
14. HAZARD LAMPS - The hazard lamp system shall be controlled by a heavy-duty switch, which is easily identifiable.
15. HEADLAMPS - A headlamp system using Halogen, fleet/truck type, extended life, bulbs (minimum rating of 2,000 hours @ 14.0 volts) shall be installed. A single dash mounted headlight switch shall control the headlamps, park lights, clearance/marker lights, and dash/control panel lights. The headlight dimmer switch shall be located on the steering column.
16. INTERIOR LIGHTING - Interior lighting shall consist of a minimum of eight (8) flush mounted dome lamps. A four inch (4"), white, LED stepwell light shall be wired into the chassis headlight circuit in such manner that it can burn only if chassis lights are "ON", the entrance door is open, and the ignition switch is in the "ON" position.
17. LICENSE PLATE LAMPS - Two (2) rear license plate lamps shall be provided one (1) on each side of the rear body panel (Truck-Lite 15205 or approved equal).
18. STOP/TAIL LAMPS - All buses shall be equipped with four (4) combination red stop/tail lamps. Two (2), LED lamps providing a minimum of 38 sq/in of lighted surface area for each lamp shall be located just below the rear windows, inside of the turn signals and as far apart as possible. Two (2), LED

lamps four (4) inch in diameter shall be located at the approximate floor line and as near the outer edges of the bus as possible. Stop lamps shall be activated by the service brakes and shall emit a steady light when illuminated.

19. STROBE LAMP - All buses shall be equipped with a white strobe lamp having a minimum rating of ten (10) joules, double flash, and a maximum height of six inches (6"). The strobe lamp flash tube shall be warranted for a minimum of twelve (12) months. All other components shall be covered for the full warranty period.

Lamp shall be located on the roof centerline within thirty-six inches (36") from the rear of bus. This light shall be wired so as to operate with the ignition switch and the circuit shall be protected so that a short at the strobe lamp will not adversely affect any other component. A protective guard angled from the front shall be designed and installed to allow limbs or low hanging objects to ride over the lamp.

20. TURN SIGNAL LAMPS - All buses shall be equipped with four (4), LED lamps providing a minimum of 38 sq/in of lighted surface area for each lamp. These shall be located two (2) on the front just below the windshield and two (2) on the rear just below the rear windows. All turn signal lamps shall be located as near the outer edges of the bus as possible.

Additionally, four (4) side mounted turn signal lamps (same as clearance lamps), two (2) on either side shall be mounted above the tires and centered between the top two (2) rub rails. These lamps shall be red at the rear tires and amber at the front tires.

The design of the system shall be such that if any signal lamp fails to function by reason of a burned or open circuit, the action of the dash mounted indicator lamp will indicate a malfunction.

## **LETTERING**

All lettering to be painted or high quality automotive type vinyl and shall be black unless specified otherwise herein.

9. EMERGENCY EXITS - The words "EMERGENCY EXIT" shall be applied in two inch (2") letters directly above each emergency exit on both the inside and outside of the bus.
10. FRONT & REAR - The words "SCHOOL BUS" shall be applied in eight inch (8") letters with a one inch (1") minimum stroke. These shall be located in one line and between the flashing lights with "SCHOOL BUS" being placed on a retro reflective background approximately ten inches by thirty-six inches (10"x36").

11. FUEL DOOR - "DIESEL" in two inch (2") letters shall be applied directly over the fuel filler door.
12. INTERIOR - The words "RATED SEATING CAPACITY, \_\_\_\_\_ PASSENGERS" shall be applied in two inch (2") letters near the ceiling, at front of bus, above the windshield and visible to all passengers.
13. INTERIOR - The words "EMERGENCY EQUIPMENT COMPARTMENT" in one and one half inch (1 1/2") red letters shall be applied on the overhead compartment in the driver's area used for storing emergency equipment. Individual emergency equipment items shall be listed using one inch (1") red lettering.
14. INTERIOR - Each seat shall have number/letter designations applied overhead using two inch (2") lettering. The number designations shall be by row starting with number one (1) at the front. The letter designations shall be L for left side and R for right side as viewed from a forward facing position.
15. NUMBERING - The SCDOE,T shall provide an eight (8) digit identification number to the contractor for each bus constructed. These numbers shall be applied using four inch (4") digits, except as noted, in the following locations:
  - a) Left Side - below driver's window and centered between the top two (2) guard rails,
  - b) Right Side - just aft of the service door and centered between the top two (2) guard rails,
  - c) Rear - Centered horizontally below the rear window, and
  - d) Inside - above service door (2" lettering)
16. SIDES - The words "SOUTH CAROLINA PUBLIC SCHOOLS" in six inch (6") letters shall be applied directly under windows and centered front to rear.

### **LICENSE PLATES**

All buses shall be equipped to accommodate license plate installation as follows; two (2) locations on the rear (one (1) on either side) and one (1) location on the front bumper. All necessary attaching hardware shall be included.

Two (2) blank metal plates, (minimum 22 gauge), approximately six inches by twelve inches (6"x12") with rounded corners shall be painted on both sides and installed one (1) on the right rear and one (1) on the front bumper.

### **LOGOS, MANUFACTURER'S**

No manufacturer's logos or names may be placed on the bus exterior except a small nameplate may be installed in an approved area.

### **LUBRICATION**

Chassis lubricating system shall be high-pressure type with standard hydraulic type grease fittings. Fittings shall quick attachment type and shall be positioned so as to be easily accessible for maintenance and service without removal of panels/components.

## **MIRRORS**

3. EXTERIOR MIRRORS - All buses shall be equipped with an exterior mirror system. Certification of the indirect view provided by the mirror system and the driver's direct view of the ground shall be provided at the time of the pilot inspection. In addition, the following specifications shall be met:

- c. REAR VISION MIRROR SYSTEM - All buses shall be equipped with a rear vision mirror system, which incorporates independently adjustable convex and flat glass mirrors. These shall be mounted, (1 convex and 1 flat glass) on both the left and right sides of the bus (Mirror Lite, Rosco, or approved equal).
- d. CROSSVIEW MIRROR SYSTEM - All buses shall be equipped with a cross view mirror system. This system shall incorporate not less than one (1) mirror installed on each front corner of the bus.

All mirrors shall be mounted so as to isolate them from vibration. Any bracketing or supports shall be adequately braced to eliminate breakage. If mounting is secured through fiberglass and/or body panels; bolts, locking nuts, and backing plates shall be used. The mirror manufacturer must approve all mirror mounting and bracketing.

4. INTERIOR MIRROR - (1) interior, driver adjustable (6" x 30") convex rearview mirror (Tiger 1544 w/ bracket or approved equal) shall be mounted above windshield to provide the driver with full view of bus interior.

## **MOUNTING**

The body shall be properly insulated from the chassis by use of rubber and/or fiber inserts at every contact point. The body shall be securely attached to the chassis frame with mounting bolts and clamps. These shall be of a design that eliminates clamps rotating around the bolts during normal operation.

## **MUD FLAPS**

Mud flaps shall be provided for the rear wheels, shall be black rubber and shall display no manufacturer's logos.

## **PAINT**

All paint shall be lead free, high baked enamel, thermo-setting acrylic enamel, catalytic acrylic or two (2) part polyurethane enamel.

Prior to application of the finish coats to the body; all surfaces shall be cleaned of grease, foreign matter, excessive body caulking and sealing material and then treated as per paint manufacturer's recommendation for proper paint adhesion.



School Bus Yellow paint shall meet the color standard as specified in the School Bus Manufacturer's Technical Council Publication SBMTC-008 and shall have a finish gloss rating of at least ninety (90) at sixty (60) degrees and an average distinctness of image rating of at least sixty (60). Topcoat shall be applied for a total dry film thickness of 1.8 mils to 2.2 mils over all painted surfaces.

Body paint finish coats shall be warranted for a minimum of sixty (60) months (100% parts and labor) for adhesion, color retention, and gloss retention. Acceptable variations from original paint finish are as follows:

4. ADHESION - Paint and priming compounds shall not fail to adhere to the bus with normal use and care.
5. COLOR RETENTION - During the first thirty-six (36) months from the in-service date the color shall not shift colors more than four (4) Delta E from the centroid as specified in the School Bus Manufacturer's Technical Council Publication SBMTC-008. During the sixty (60) month warranty period the color shall not shift more than eight (8) Delta E from the centroid as specified in SBMTC-008.
6. GLOSS - During the first thirty-six (36) months from the in-service date the gloss reading shall not fall below sixty (60) at sixty (60) degrees. During the sixty (60) month warranty period the gloss reading shall not drop below thirty (30) at sixty (60) degrees.

All measurements shall be the average of twelve (12) readings taken at various points on the bus but no reading shall be more than three (3) points under the stated minimum and shall be taken after the bus is thoroughly washed to remove road film and dust.

## PAINT COLOR

### *Color Requirements*

Black, Gloss	Bumpers, guard rails, blank license plates, and chassis.
Gray	Wheels
Interior	Manufacturer's Standard at time of production (except aluminized or Galvalume panels)
White	Roof panels down to within five inches (5") of the window drip rails
Yellow	(National School Bus Yellow) Exterior paneling and hood
Other	Seat frames may be manufacturer's standard,

**PANELING**

All paneling shall be installed in a manner that will eliminate wrinkling, buckling and cracking.

5. EXTERIOR - Roof panels shall be of not less than twenty (20) gauge, sheet steel panels formed to fit the roof bows. Panel joints shall overlap at the bows for the full width of the bow and shall be securely riveted or bolted to bow flange. All joints shall be sealed to render them completely watertight.
6. INTERIOR - The interior panels shall be embossed aluminized steel or Galvalume not less than twenty-two (22) gauge and securely fastened to frame members from the bottom of side windows to top of seat rails.
7. HEADLINING - The interior roof panels, except perforated sections shall be not less than twenty-two (22) gauge sheet steel. A minimum of the last two sections (minimum of 50 inches) from the rear shall be sheet steel perforated acoustical paneling. (An approved scrim type material shall be installed between the acoustical panels and insulation to eliminate insulating particles dropping through perforated panels.) The acoustical panels shall have a minimum of two inches (2") non-perforated steel at lapped joints or shall have perforated edges folded and doubled for attachment to roof bows.
8. SIDE, FRONT, AND REAR PANELS - Panels shall be not less than twenty (20) gauge and shall be securely fastened to each body post.

**RADIATOR/AFTERCOOLER**

Heavy-duty, truck type radiator exceeding engine and transmission manufacturers heat rejection requirements shall be furnished and mounted so as to prevent undue strain and vibration being transmitted to it through attaching parts. The radiator and coolant recovery system shall carry the same warranty as the engine.

The radiator core shall be a welded coolant tube to header joint type. Aftercooler shall be securely mounted so as to alleviate rubbing against the radiator. All piping for the aftercooler shall be aluminized steel.

All cooling systems shall be equipped with a coolant recovery/deaeration system with over flow vent hose to route coolant away from engine compartment. A means for visibly checking the coolant level without opening the system shall be provided. The recovery/deaeration tank will have a decal affixed to identify the type of coolant used in the system.

All plumbing shall be adequately secured and braced. All hoses shall be of a Type B, Class 2, level A, grade 1 construction. All hoses one inch (1") and larger shall be secured using stainless steel, constant torque, worm gear driven clamps. Hoses making sharp bends, turns or angles shall be molded hoses. Flex/ribbed hoses are not acceptable. Unless otherwise specified, all rigid coolant plumbing shall be stainless steel.

Plumbing shall be designed so that all curves and bends are made using non-corrosive pipe or tubing. Any rubber hose used in the system shall be straight.

Any component or plumbing of the Radiator/Aftercooler systems located closer to the ground, than the lower edge of the rear bumper, shall be protected by skid plates. There shall be no additional coolers mounted between the radiator and the aftercooler. Design and mounting shall be such that will prevent the accumulation of dirt and debris between the radiator and aftercooler and shall provide for easy cleaning without removing any component.

### **RECOVERY ATTACHMENT POINTS**

Recovery points shall be provided on both the front and rear of the bus. These points shall allow recovery of the bus without causing damage to either chassis or body parts, when pulled horizontally anywhere from zero (0) degrees through a forty-five (45) degree cone angle or vertically, based on pull strength requirements listed below.

#### ***Pull Strength Requirements***

<b>Direction of Pull</b>	<b>Single Recovery Point</b>	<b>Dual Recovery Points</b>
Horizontal @ 0 Degrees	100% of GVWR	50% of GVWR (each Point)
Horizontal @ 45 Degrees	140% of GAWR	70% of GAWR (each Point)
Vertical (perpendicular to frame)	100% of GAWR	50% of GAWR (each Point)

### **REFLECTIVE CONSPICUITY MARKINGS**

All retro reflective material used on the bus shall be a Type V as defined by ASTM-D-4956-90.

5. EXITS - All emergency exits shall be outlined on the outside of the vehicle with a retro-reflective yellow material approximately one inch (1") in width.
6. FRONT - "SCHOOL BUS" lettering on the front shall be backed by retro-reflective yellow material.
7. REAR - "SCHOOL BUS" lettering on the rear shall be backed by retro-reflective yellow material. Additionally, the rear of the bus body shall be marked with a strip of retro reflective yellow material. This material shall be approximately two (2") in width and shall be applied as follows: extending from the left lower corner of the "SCHOOL BUS" sign across to the left side of the bus, then vertically down to the top of the bumper, across the bus on a line immediately above the bumper to the right side, then vertically up to a point even with the strip placement on the left side and concluding with a horizontal strip terminating at the lower right corner of the "SCHOOL BUS" sign.
8. SIDES - The sides of the body shall be marked with retro-reflective yellow material at least two inches (2") in width, extending the length of the bus body, and located (vertically) as close as practicable to the belt line.

**REFLECTORS**

The body shall be equipped with eight (8), three inch (3") acrylic plastic reflectors mounted in aluminum frames (Peterson 472 or equal). Three (3) reflectors shall be mounted on each side of the bus, one (1) at the front, one (1) at the center, and one (1) at the rear. Two (2) reflectors shall be mounted on the rear of the bus located as far apart as body contours will permit.

All reflectors shall be attached by a minimum of two (2) screws or rivets. Reflectors mounted in front of the rear wheels shall be amber. Reflectors mounted behind the rear wheels shall be red.

3M Diamond Grade, DOT 988 approved reflectors may be used in lieu of Petersen 472.

**REGISTRATION CARD HOLDER**

A vinyl type holder approximately four inches by five inches (4" x 5"), having a transparent front shall be securely mounted for use in displaying vehicle registration and insurance cards. This holder shall be riveted over the driver's window in an area approved by SCDOE,T.

**RUST PROOFING**

Unless otherwise specified herein, all sheet metal and body frame parts (12 gauge or thinner) shall be made of mill applied zinc coated steel having a minimum of one half ounce (1/2 oz) and three quarter ounces (3/4 oz) of zinc per square foot respectively. All body frame parts thicker than twelve (12) gauge shall be primed and coated using a rust inhibiting material. Prior to the application of a primer in preparation for painting, all metal shall be thoroughly cleaned and treated.

All bolts, nuts, screws, and washers used in the completion of body shall be stainless steel or thoroughly treated in an approved manner to prevent rusting. All screws within reach of seated children shall be Torx or Phillips head.

**SAFETY BARRIERS**

Safety barriers shall be the same height as passenger seat backs. Materials used in safety barriers must be consistent with materials used in passenger seat backs.

**SEAT AND SEAT BELT, DRIVER**

3. DRIVER'S SEAT - The driver's seat shall be air suspension type, high back design and shall be positioned with the centerline of the seat on the centerline of the steering wheel.

The seat back shall be of a one (1) piece construction and designed so as to minimize the potential for head and neck injuries in rear impacts, while providing minimum obstruction to the driver's view of the passenger area.

The height of the seat back shall be sufficient to provide the specified protection for up to a ninety-fifth (95<sup>th</sup>) percentile adult male, as defined in FMVSS 208. The driver's seat cushion shall be of a semi bucket design.

The driver contact area of the seat back and seat cushion shall be covered in a stain and wear resistant type, fabric upholstery material. The remaining areas shall be covered using a heavy weight (minimum 42 ounces) vinyl upholstery material.

The driver's seat shall be adjustable fore and aft a minimum of six inches (6"), up and down a minimum of four (4) inches, and shall include a minimum of fifteen (15) degree tilt back adjustability. All adjustment controls shall be designed for finger type adjustments and shall not require the use of tools. There shall be a minimum of ten inches (10") clearance between the steering wheel and driver's seat back regardless of seat or wheel position.

4. DRIVER'S SEAT BELT - A Type 2 combination lap belt/shoulder harness shall be provided for the driver. This assembly shall incorporate an Emergency Locking Retractor (ELR) for the shoulder harness and lap belt and a single push button release mounted on the right side at seat level.

Shoulder harness shall incorporate an adjustable mechanism to eliminate chaffing of driver's neck. This mechanism shall accommodate drivers ranging in size from fiftieth (50<sup>th</sup>) percentile adult female to ninety-fifth (95<sup>th</sup>) percentile adult male. Installation shall require approval by the SCDOE,T.

Installation of this belt shall be accomplished by use of a metal bracket to move the belt closer to the seat cushion and improve driver accessibility to the belt ends. The right side of the belt shall be guided or anchored at the seat frame, using a metal loop or similar device, so as to prevent the driver from sliding sideways off the seat.

## **SEATS, PASSENGER**

Seats shall be forward facing, shall be thirty-nine inches (39") wide and a minimum of fifteen inches (15") deep and shall be arranged in rows of two (2). Knee room for all seating shall be not less than twenty-five inches (25") when measured on the centerline of the seat at cushion height. Padded seat back shall be twenty-four inches (24") high measured at the seating reference point.

5. SEAT BACK – All seat foam shall have a listing type covering cemented to the front, back, top, sides, and over all glued seams of the seat back pad to hold foam in place.
6. SEAT CUSHION - The seat cushions must have a minimum base of fifteen thirty seconds inch (15/32"), four (4) ply, CDX plywood, or approved equal, and be fastened securely to the frame at not fewer than four (4) fixed points. If pivoting type latch is used, screws must be installed to prevent pivoting.

7. SEAT FRAME – Seat frames shall incorporate a solid wood or plywood tack strip (minimum 1 inch in width and full length) at attaching point for seat covers to allow for stapling. Seat back panels shall be constructed of full width plywood (minimum 11/32") or sheet steel (minimum 24 gauge) having sufficient strength to prevent breakage and or tearing of panels under normal use.
8. UPHOLSTERY FABRIC - All passenger seats backs, seat cushions and safety barriers shall be fully covered (no exposed wood) with a brown fire block material. It shall comply with the following specifications:
  - Mfg.: Athol, Kevlar Mfg., or Spradling
  - Brand: Proform or equivalent
  - Weight of Film: 38-oz linear yd.
  - Finish Weight of Material: 25-oz/sq. yd.
  - Product Specifications/Testing:
    - Grab tensile (lbs.) ASTM-D751
    - Tongue tear (lbs.) Fed 191A-51334
    - Tack tear (lbs.) ASTM D751-79 mod.
    - Trapezoid tear (lbs.) ASTM D1117
    - Adhesion (lbs./in.) ASTM D751
    - Seam breakage - AMC method
    - Flex testing (1 hr.) CFFA-10
    - Blocking-Fed Standard 191-5872
    - Low temperature (-20) #5 roller Fed STD 191A-5872
    - Abrasion (Wyzenbeek) Fed standard 191A-5304 240 grit-1000
    - Puncture Test 28 lbs.
  - Flammability Testing:
    - FMVSS - 302
    - FAR 25.853
    - Boston bag
    - National School Bus Standards fire block materialAll upholstery material shall be installed in such a manner as to fit snugly, eliminate wrinkles and provide a smooth appearance. Material shall be stapled a minimum of once every four (4) inches.

### **SERIAL NUMBER PLATE**

Metal plate or decal shall be installed in the bus body on the left front header panel. A clear protective laminate must be installed over all decals. Letters and numbers on plate shall be permanently marked, legible and of minimum size 10 font.

The information that must be displayed shall include: Manufacturer's Name, VIN, Maximum GVWR, and Manufacturing Completion Date.

Any of the requested information that can not be provided on the manufacturer's serial number plate, shall be permanently displayed on a metal plate or decal located adjacent to the serial number plate.

**SHOCK ABSORBERS**

The chassis shall be equipped with heavy-duty, double-acting hydraulic front and rear shock absorbers compatible with rated axle capacity. The shocks shall be mounted to a bracket affixed to the frame with rivets or minimum of grade eight bolts.

**STEERING**

All chassis shall be equipped with power steering of the integral type and gear driven hydraulic pump. If the hydraulic pump supplies pressure to components other than the steering gear, a priority valve shall be installed giving priority to steering over other components.

All plumbing from the power steering pump to the steering gear box shall have a minimum recommended working pressure of three thousand pounds per square inch (3,000 PSI).

Steering wheel shall be a minimum of eighteen inches (18") in diameter and shall have a minimum clearance of three inches (3") from the instrument panel, windshield or any other surface.

Steering column shall be equipped with tilt function and shall provide for easy adjustment. If these functions are not hand actuated, the controls must be positioned to alleviate accidental operation. Any u-joint needing lubrication used in the steering shaft, must be able to be lubricated using normal lubrication equipment, and shall be accessible without removing any panels.

**STOP ARM AND CROSSING CONTROL ARM**

Stop arm and crossing control arm shall be installed to automatically activate in conjunction with the red flasher lights. The air source for stop arm and crossing control arm activation shall be the accessory supply reservoir. A pressure protection valve shall protect this air supply. Control valves used for regulating air pressure, for the stop arms and crossing control arms shall be mounted behind electrical access door/panel and shall be equipped with a locking feature on the adjusting knob.

1. STOP ARM - All buses shall be equipped with a stop signal arm that is air operated and equipped with a wind deflector. The word "STOP" shall be applied in white, six inch (6") letters on a red reflectorized background. Lighting shall be red, alternately flashing, strobe type LED.
2. CROSSING CONTROL ARM - All buses shall be equipped with an air operated crossing control arm. The crossing control arm shall be mounted on the front bumper and hinged on the right side of the bus.

**STORAGE, DRIVER**

A storage compartment located over the driver's side window shall be provided. This compartment shall have a bottom base plate of metal and shall be lockable. Key shall not be CH 545.

**SUN VISOR**

One (1), sun visor (Tiger 1522 or approved equal) shall be mounted so as not to interfere with the opening and closing of overhead storage compartments. Visor must be easily adjustable by driver and must have all corners rounded.

**SUSPENSION, FRONT**

Front suspension shall be spring type with a minimum per spring rating at ground of six thousand (6,000) pounds. Hanger brackets shall be secured to frame with a minimum of grade eight bolts.

**SUSPENSION, REAR**

Rear suspension shall be air ride type and shall have a rating equivalent to the axle capacity. A single, load sensitive, self-leveling control valve shall be incorporated to maintain constant ride height. This valve shall be adjustable and shall be installed on the centerline of the bus.

Ride Height Dimension shall be defined as the distance from the centerline of the rear axle to the bottom of the frame rail when the bus is in an unloaded condition. All hanger/mounting brackets shall be fastened to frame with a minimum of grade eight bolts. A load distributing plate shall be provided at the attachment points for the torsion control arm.

**TIRES AND WHEELS/RIMS**

All chassis shall be equipped with six (6) tires conforming to the following table. All tires shall be of the same manufacturer, size, and load rating.

***Tire Sizes***

<b>Manufacturer</b>	<b>Type</b>	<b>Size</b>	<b>Load Range</b>
Goodyear	G395	295/75R x 22.5	G
Michelin	XZE	275/80R x 22.5	G
Bridgestone	R299	295/75R x 22.5	G

All chassis shall be equipped with two (2) front and four (4) rear, ten (10) hole disc wheels (Accuride 8.25 x 22.5 or approved equal). Wheels shall be hub pilot type with five (5) hand holes. All wheels shall be fully painted with a hardened epoxy type paint to provide a uniform color.

All tires/rim assemblies shall be dynamically balanced. Any tire not balance correctable with less than twenty (20) ounces of weight shall be replaced. All tires shall be evaluated during pre-delivery service road test. Any tire deemed out of balance during road test shall be corrected.



One (1) spare tire and rim assembly (same as provided on the chassis) shall be provided for each bus. The tire and rim assemblies shall be mounted, inflated, and ready for use when delivered.

### **TRANSMISSION**

The transmission shall be fully automatic, electronically controlled and have a minimum of five (5) forward ratios, neutral, and reverse (Allison PTS 3000 series). The transmission shall incorporate an integral type filter that is externally accessible without removal of the transmission oil pan. The transmission assembly must be installed so that it can be removed for service without cutting of cross members. A back-lighted, touch pad/push button type control shall be provided to facilitate transmission gear selection.

### **VENTILATOR**

A static type roof exhaust ventilator shall be installed over the center aisle at a point approximately five feet (5') from the rear of the bus. The interior opening of the ventilator shall have a wire mesh cover. The ventilator shall be designed to provide full protection from rain and to exhaust air from within the bus body. This ventilator shall be of sufficient capacity to maintain the proper quantity of air flow under operating conditions without opening windows except in extremely warm weather.

### **WEIGHT DISTRIBUTION**

The weight distribution of a fully loaded bus on level surface shall provide approximately seventy percent (70%) of gross vehicle weight on the rear tires and approximately forty percent (40%) on the front tires.

### **WHEELHOUSINGS**

Wheelhouse opening shall allow for easy tire removal and service. Replaceable wheelhouse molding is required. Replaceable formed rubber wheelhouse extension shall be mounted around rear wheelhouse openings.

Wheelhousing shall be at least sixteen (16) gauge or heavier, designed to support seat and passenger loads and shall be secured to the floor sheets in such a manner to prevent dust or water from entering the body. All seams between the wheelhousing and body side panels shall be sealed. Inside height of wheelhousing above floor line shall not exceed ten inches (10").

### **WINDOWS**

2. SIDE WINDOWS - A split sash window shall be provided on each side of bus between each two (2) frame pillars. Top sash shall be controlled by finger operated controls. When in the open position, these windows shall provide a minimum unobstructed opening of twelve inches by twenty-two inches (12 " x 22"). A suitable visor, drip rail or similar water shedding device shall be provided for each window.

Window latches shall be designed to minimize projection type injuries and to insure against the inadvertent opening of windows when traveling on unpaved or uneven surfaces. Window latches and sliding mechanisms shall be repairable and/or rebuildable without disassembling the window frame or removing window from bus body. Individual latches or repair parts must be available and part numbers included in the published parts catalog.

4. DRIVER'S WINDOW - A sliding type window shall be provided at the left of the driver, which can be conveniently operated from the driver's seat. The window shall be provided with an approved sash and locking control and shall afford an opening of sufficient size to provide adequate driver visibility. The lower window channel shall have a self-draining feature to prevent the collection of water and prevent internal leakage.
5. REAR WINDOWS – If non-opening windows are provided on the rear of the bus, they shall be located on each side of the emergency door, shall be uniform in size and shall be of a flat glass design. These windows shall be properly lined up with the rear glass and with the side windows.
6. PRISM - A Rearscope prism designed to give the driver a wide angle view of the area immediately behind the bus shall be mounted to the center area of the emergency window.

### **WINDSHIELD WIPERS AND WASHERS**

3. WINDSHIELD WIPERS - The body shall be equipped with heavy duty, two (2) speed with intermittent function, electric windshield wipers. Wiper motor shall be easily accessible for maintenance and repair. A single switch shall control the wiper motor(s).
4. WINDSHIELD WASHERS - The body shall be equipped with an electrically operated windshield washer system. The nozzles for this system shall be mounted on the windshield wiper arm. The windshield washer fluid reservoir shall be constructed of rigid plastic and have a minimum capacity of two (2) quarts. This reservoir shall be mounted in a position that is easily accessible for refilling.

### **WIRING**

Multiplexing/Electronic system control technology shall be acceptable in lieu of circuit breakers, specified circuits and/or other electronic controls.

All wires shall be supported and secured at intervals not to exceed eighteen inches (18"), except that wiring located across the window headers shall be supported at each roof bow and shall be insulated and protected by a covering of plastic loom or approved equivalent. At any point where the wiring must pass through metal members, the edges must be de-burred and bushed with approved rubber grommets. All body wiring shall be fully concealed, protected, and enclosed in a removable cover extending from front to rear of body.

All electrical terminals and/or splices shall be joined to the wiring by means of machine crimp, ratchet crimp, or hand crimp and soldering. All terminal to wire connections must be made using sealed connectors or terminals with sealed heat shrink tubing. All wiring connections at junction blocks, terminal strips, and/or bus bars shall be made using stud and nut type junction blocks.

All chassis shall be wired so that the only current draw allowable, when the ignition switch is in the off position is from the brake lights, hazard lights, and horns. Electronic components (example: voltage regulator) having constant current draw of less than 30 milli-amperes are excluded from this requirement. A manually resettable circuit breaker (minimum 150 amp) located in the electrical access panel shall be provided to protect all body feeds.

3. CIRCUITS - Wiring shall be arranged in protected circuits that are properly labeled. Automatic or manual resetting circuit breakers of the appropriate amperage shall be used in circuits 5 amps and greater. Fuses may be used in circuits of 5 amps or less.
4. CIRCUIT IDENTIFICATION – All circuits shall be identified by a minimum of two (2) separate methods, which shall be any combination of circuit number, circuit color, or circuit name. Circuit identification letters or numbers shall be printed on the wire not less than every eight inches (8").
  - d. Circuit number shall be those used by the individual vehicle manufacturer or harness manufacturer.
  - e. Circuit colors shall be those specified by SAE standards or the 2005 National School Transportation Specifications and Procedures
  - f. Circuit name identification shall be standard nomenclature or abbreviations.
4. CONTROL PANEL - A control panel for heater, warning light, wiper switches, etceteras shall be located below the driver's window. The positioning of all switches/controls shall provide for easy driver access and identification. Switches with similar functions shall be grouped.

A "Noise Suppression Switch" identified by contrasting color, shall be provided within easy access of the driver and shall be wired to interrupt the operation of all noise producing accessories (blowers, fans, etceteras).

A 12-volt accessory outlet shall be located in an area that is accessible to the driver to facilitate cellular phone installation. Outlet must be equipped with an attached plastic cover.

A 12-volt power supply wire minimum 14 gauge, shall be routed, terminated, and capped at the driver's storage compartment and properly labeled. This power supply will be used for future installation of radios

Dual power supply wires (ignition feed and constant 12 volt), minimum 14 gauge, shall be routed, terminated, and capped at the control panel/electrical

access panel and properly labeled. This power supply will be used for future installation of cameras.

A wiring bundle to accommodate the installation of GPS systems shall be provided. This bundle shall at a minimum include feeds for 12 volt power supply, stop arm operation, engine speed, engine temperature, engine oil pressure, and brake (service & park) application.

4. RELAYS - There shall be provided a minimum of two (2) (minimum 100 amp) constant service, heavy duty master relays, which are to be actuated by the ignition switch and through which all electrical accessories except the turn signal units are to be wired.

Wiring from the chassis to the relays and from the relays to the fuse block shall be a minimum of four (4) gauge wire. One (1) master relay shall supply current for the lights, stop arm lights, and Child Safety Alarm. The other master relay shall supply current for all noise producing devices such as heaters and fans.

### **Additional Specifications For Special Needs Buses (35 Passenger Only)**

Body construction shall conform to all preceding specifications for regular school buses with the following additions:

#### **ASSIST RAIL**

A stainless steel assist rail shall be installed on all units on the passenger seating side of the entrance stepwell. This rail shall be securely mounted and installed in such a manner as to afford easy accessibility to small children during bus entry and/or egress.

#### **CHILD SAFETY SEATING**

Each Special Needs school bus shall be equipped with four (4) seats designed and equipped for the normal transport of three (3) passengers or the secured transport of two (2) toddler size (20-40 pounds) passengers. The securement devices for the toddler size passengers shall comply with FMVSS 213 and shall be an integral part of the seat. When not transporting toddler size passengers, these devices must be capable of being stored within the seat without any belts, buckles or other devices protruding into the seating area.

If the securement devices used for restraining toddler size passengers can not be used to accommodate infant size (0-20 pounds) passengers, then non-integrated carriers specifically designed for installation in these seats must be available.

The preferred positioning for these two (2) seats is the first and second seats from the front on the entrance door side of the bus. All seating positions that are equipped to accommodate Child Safety Restraint Systems must be installed in accordance with the National Highway Traffic Safety Administration, Guideline for the Safe Transportation of Pre-School Age Children in School Buses.

#### **IDENTIFICATION**

All buses equipped with a wheel chair lift shall have affixed, three (3) universal wheelchair symbols. These symbols shall be of a high intensity reflectorized material, white on blue background, and approximately six inches (6") square.

These symbols shall be located, one (1) on the left front corner, one (1) on the lift door and one (1) centered on the rear of the bus. All symbols will be located below the window line and in an approved area.

#### **LAMPS**

All buses equipped with a lift shall have an additional lamp on the interior of the lift door area. These lamps shall be of sufficient size and adequately mounted so as to illuminate the lift platform and lift door area. These lamps shall be wired to automatically operate with the headlights "ON" and the lift door opened.

#### **LIFT**

All special needs buses shall be equipped with a fully automatic (including storage) Americans with Disabilities Act compliant electric-hydraulic lift having a minimum design load rating of eight hundred (800) pounds. Installation shall comply with the requirements of the 2005 National School Transportation Specifications and Procedures. Interlock shall provide for locking the brakes and disabling throttle. Brake interlock shall be accomplished by controlling the flow of air to the system and not by placing a blocking device on the park brake control knob.

Lift must be designed so that when it is necessary to operate the lift manually, the oil will return to the reservoir and loosening the hose will not be required. Lift must be designed to stop when platform reaches ground level so as not to raise bus body.

Pump shall be wired through the ignition so that lift will not operate unless ignition switch is on. Lift controls shall be on the end of a ninety six inch (96") cable.

### **LIFT DOOR**

Lift opening shall be enclosed by a single door that is hinged to the front and positioned in such a manner as to alleviate blocking the service door when in a fully opened position. This door shall extend from the window header to the floor and shall not require cutting into the area above the drip rails for installation.

The door shall have a glass window (minimum 400 sq/in), set in a waterproof manner, compatible with, and set up to the lower line of adjacent sash. Provisions shall be made for fastening the door in a wide-open position. The lift door opening shall be covered by a drip rail that is designed to shed water away from the lift platform area.

### **LIFT DOOR ALARM**

The lift door alarm shall consist of a combination of a buzzer and a flashing light. The buzzer/alarm shall be located at the driver's control panel. The flashing light shall be located in an area that is easily visible to the driver. The flashing light shall be red in color and be approximately one inch (1") in diameter. It shall be labeled "LIFT DOOR ". Lift Door Alarm shall operate as follows:

1. When the door is in the closed position and the door latch is in an open position; an alarm buzzer shall sound.
2. When the door is moved to an open position, the buzzer will automatically deactivate the flashing light on the control panel will be activated.
3. When the door is returned to the closed position, with the door latch in the closed position, both the buzzer and the light will be deactivated.

### **RESTRAINING BELTS**

Manually adjustable restraining belts shall be provided for each seated passenger. Belt length shall be sized so as to provide restraint for passengers from a fiftieth (50<sup>th</sup>) percentile six year old child to a ninety fifth (95<sup>th</sup>) percentile adult male. Belts shall be color coded (black, brown and red) to reduce problems of mixing seat

belts. Black belts shall be located on the window side and brown belts shall be located on the aisle side.

**SAFETY BARRIERS**

Safety barriers that are FMVSS certified shall be installed behind the driver's seat and at the service door stepwell, regardless of seating arrangement and wheel chair positions.

**SEATING ARRANGEMENT**

The thirty-five (35) capacity body shall be equipped with eleven (11), thirty-nine inch (39") seats and two (2) wheel chair positions

**WHEEL CHAIR/OCCUPANT RESTRAINTS**

All positions designated for use in transporting wheel chairs shall be equipped with a wheel chair/occupant securement system (TIE-TECH model #700-42R-01). This system shall be complete with crotch strap and automatic tensioners for the wheel chair restraint straps.

Training and/or operator's manuals shall be provided showing the manufacturer's recommendations for attachment, securement, and belt positioning.

**OPTIONS**

23. AIR CONDITIONING - Cost to provide interior air conditioning system (free blow) meeting specifications found in Appendix?
24. ALTERNATOR -Cost to provide 200-amp brushless alternator in lieu of 160-amp unit?
25. CAPACITY - Cost to increase seventy eight (78) passenger bus as specified to eighty one (81) passenger capacity?
26. CHILD SAFETY SEATING - Cost to provide an infant carrier (0-20 lbs.) for installation into existing seating?
27. ENGINE - Cost to provide 250 HP engine with 660 ft/lb torque?
28. LETTERING - Cost to provide lettering on the sides of the bus to read "South Carolina School for the Deaf and the Blind"?
29. LETTERING - Cost to provide lettering to reflect school district name or number?
30. LOCKS, KEYED VANDAL - Cost to provide complete body keyed vandal locks for all entrance/exits accessible from the ground?
31. MULTI-FUNCTION SCHOOL ACTIVITY BUS - Deduct to delete, Child Safety Alarm, Crossing Gate, Stop Arm, School Bus lettering, and Flashing Signal Lamps?
32. MIRRORS, EXTERIOR - Cost to provide heated exterior side view mirrors?
33. MIRRORS, EXTERIOR - Cost to provide remote controlled exterior side view mirrors?
34. PANELS, ACOUSTICAL ROOF - Cost to provide acoustical roof panels full body front to rear on thirty five (35) or sixty six (66) passenger body?
35. PANELS, ACOUSTICAL ROOF - Cost to provide acoustical roof panels full body front to rear on seventy eight (78) passenger body?
36. PANELS, ACOUSTICAL ROOF - Cost to provide acoustical roof panels full body front to rear on eighty one (81) passenger body?
37. PLYWOOD FLOORING - Cost to provide full body plywood flooring minimum thickness 5/8 inch CDX on thirty five (35) or sixty six (66) passenger body?
38. PLYWOOD FLOORING - Cost to provide full body plywood flooring minimum thickness 5/8 inch CDX on seventy eight (78) passenger body?



- 39. PLYWOOD FLOORING - Cost to provide full body plywood flooring minimum thickness 5/8 inch CDX on eighty one (81) passenger body?
- 40. PUBLIC ADDRESS SYSTEM - Cost to provide a public address system with interior and exterior speakers. No internal speakers, other than the driver's communication system, may be installed within five feet of the driver's seat back in its rearmost position. The driver's communication system (microphone and controls) shall be installed within easy reach of the driver while seated in the driver's seat, but shall not be easily accessible to passengers?
- 41. RESTRAINING BELTS - Cost to provide manually adjustable restraining belts as specified for each passenger position on sixty six (66) passenger body?
- 42. RESTRAINING BELTS - Cost to provide manually adjustable restraining belts as specified for each passenger position on seventy eight (78) passenger body?
- 43. RESTRAINING BELTS - Cost to provide manually adjustable restraining belts as specified for each passenger position on eighty one (81) passenger body?
- 44. SEATING, PASSENGER - Cost to provide KEVLAR seat covering material for sixty five (65) passenger body?
- 45. SEATING, PASSENGER - Cost to provide KEVLAR seat covering material seventy one (71) passenger body?
- 46.
- 47. SPARE TIRE CARRIER - Cost to provide underbody spare tire carrier with attached mechanism for lowering tire/wheel assembly to ground and access door. This option shall also include necessary jack and lug wrenches for changing tire?
- 48. STEREO - AM/FM W/ PA - Cost to provide AM/FM/CD stereo system with PA and a minimum of six (6) speakers. No speaker to be located within five feet (5') of the driver's compartment?
- 49. STORAGE COMPARTMENT - Cost to provide a single outside storage compartment located under the floor, in the body skirt, and in front of the right rear wheels having an approximate size of 13" high, 15" deep, and 25" wide. Compartment shall be dustproof and watertight with door?
- 50. STORAGE, UNDERNEATH LOCKABLE - Cost to provide full length, underbody luggage storage compartments. These compartments shall be key lockable and shall be sealed to be dust proof and watertight?



# ***Appendix***

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## Request for Approved Equal

Bid Number \_\_\_\_\_

Lot Number \_\_\_\_\_

Procurement of Type \_\_\_\_\_ School Buses

_____ hereby requests consideration of the following item: (Company Name) _____ _____ _____ _____
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As an approved equal for:

Section \_\_\_\_\_ Page # \_\_\_\_\_ Paragraph # \_\_\_\_\_

Item Description \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Name: (Print or Type) \_\_\_\_\_

Title: (Print or Type) \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

### For Official Use Only

Date Received

BCB, MMO Control #

# Request for Specification Interpretation

Bid Number \_\_\_\_\_

Lot Number \_\_\_\_\_

Procurement of Type \_\_\_\_\_ School Buses

\_\_\_\_\_ hereby requests an interpretation of the following:  
(Company Name)

Section \_\_\_\_\_ Page # \_\_\_\_\_ Paragraph # \_\_\_\_\_

Statement: \_\_\_\_\_

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Our interpretation is:

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Name: (Print or Type) \_\_\_\_\_

Title: (Print or Type) \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

## For Official Use Only

Date Received

BCB, MMO Control #

## Delivery Destinations

<p>Abbeville School Bus Shop Hwy 28 By Pass Abbeville, SC 29620</p> <p>Aiken School Bus Shop 1574 Columbia Hwy. N. Aiken, SC 29801</p> <p>Anderson Bus Shop 2620 Midway Road Anderson, SC 29621</p> <p>Beaufort School Bus Shop 202 Broad River Blvd. Burton, SC 29903</p> <p>Berkeley School Bus Shop 650 Whitesville Road Moncks Corner, SC 29461</p> <p>Blackville Bus Shop 565 Country Club Road Blackville, SC 29817</p> <p>Brunson School Bus Shop Prince William Road Brunson, SC 29911</p> <p>Calhoun School Bus Shop 202 Milligan Street Saint Matthews, SC 29125</p> <p>Charleston Bus Shop 4092 Azalea Drive Charleston Hgts. SC 29405</p> <p>Cherokee School Bus Shop 3144 Union Hwy. Gaffney, SC 29340</p> <p>Chester School Bus Shop Wilson Street Ext. Chester, SC 29706</p> <p>Horry School Bus Shop 3275 Hwy. 701 North Conway, SC 29526</p>	<p>Chesterfield Bus Shop Hwy. 9 &amp; Hwy. 265 Chesterfield, SC 29709</p> <p>Clarendon School Bus Shop 210 Sumter Street Manning, SC 29102-0210</p> <p>Colleton School Bus Shop Old Airbase Road Walterboro, SC 29488</p> <p>Converse Bus Shop 537 Burns Road Spartanburg, SC 29302</p> <p>Darlington Bus Shop 212 Knotty Pine Road Darlington, SC 29532</p> <p>Dorchester Bus Shop 347 Academy Road St. George, SC 29477</p> <p>Fairfield School Bus Shop Hwy. 321 By-Pass Winnsboro, SC 29180</p> <p>Florence School Bus Shop 2614 E Nat. Cemetery Rd Florence, SC 29506</p> <p>Georgetown Bus Shop 515 Washington Street Georgetown, SC 29440</p> <p>Greenville School Bus Shop 341 Halton Road Greenville, SC 29606</p> <p>Greenwood Bus Shop 412 Wingert Road Greenwood, SC 29649</p> <p>Orangeburg Bus Shop Hwy. 301 South Orangeburg, SC 29115</p>
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Johnston School Bus Shop 865 Roland Ave. Johnston, SC 29832	Pickens School Bus Shop 680 Ireland Road Pickens, SC 29671
Kershaw School Bus Shop 205 King St. Camden, SC 29020	Richland School Bus Shop 8016 Wilson Blvd. Columbia, SC 29203
Lancaster School Bus Shop 3467 Kershaw-Camden Rd. Lancaster, SC 29720	Socastee Bus Shop 5100 lafon Lane Myrtle Beach, SC 29588
Latta School Bus Shop 7452 N. Highway 501 Latta, SC 29565	Spartanburg Bus Shop Road 41 & Casual Drive Fairforest, SC 29336
Laurens School Bus Shop Fairground Rd. Laurens, SC 29360	Summerville Bus Shop 3243 Von Oshen Road Summerville, SC 29484
Lee School Bus Shop Hwy. 341 East Bishopville, SC 29010	Sumter School Bus Shop 302 Mooneyham Road Sumter, SC 29153
Lexington Bus Shop 309 Barr Road Lexington, SC 29072	Taylors School Bus Shop 2809 Locust Hill Road Taylors, SC 29687
Lower Richland Bus Shop 1511 Rabbit Run Hopkins, SC 29061	Union School Bus Shop 1734 Jonesville Hwy. Union, SC 29379
Marlboro School Bus Shop 155 Throop Street Bennettsville, SC 29512	Williamsburg Bus Shop Hwy. 527 East Kingstree, SC 29556
Newberry School Bus Shop 1150 Airport Road Newberry, SC 29108	York School Bus Shop 1470 Hwy 324 York, SC 29745
Oconee School Bus Shop 125 East Bear Swamp Road Walhalla, SC 29691	



## Air Conditioning System Specifications

The following specifications are applicable to all types of school buses equipped with optional air conditioning package.

1. **PERFORMANCE REQUIREMENTS** - The installed air conditioning system shall cool the interior of the bus a minimum of twenty degrees Fahrenheit (20 F) in thirty (30) minutes measured at a minimum of three (3) points, located four feet (4') above the floor at the longitudinal centerline of the bus. The three (3) points shall be:
  - a) At the driver's seat area,
  - b) At the approximate mid point of the body and
  - c) Two feet (2') forward of the rearmost seating position.
2. **TEST CONDITIONS** - The test conditions under which the above performance must be achieved shall consist of:
  - a) Placing the bus in a room (such as a paint booth) where ambient temperature can be maintained at one hundred degrees Fahrenheit (100 F).
  - b) Heat soaking the bus at one hundred degrees Fahrenheit (100 F) with windows open for a minimum of one (1) hour.
  - c) Close all windows, set air conditioning system to the highest settings and operate engine at chassis manufacturer's recommended low idle speed.
  - d) Record readings at initiation of test and at thirty (30) minute interval.
  - e) At the discretion of SCDOE,T subsequent testing may be performed under actual summer conditions in South Carolina. These tests shall be performed with temperatures above eighty five degrees Fahrenheit (85F) and humidity above fifty percent (50%) with normal sun loading of the bus for a minimum of one (1) hour.
2. **EQUIPMENT REQUIREMENTS** - Type C and D buses shall utilize a dual (split) type system with both systems capable of functioning independently. Such systems shall be totally separated such that failure in one part of the system will not affect the other side of the system, including separate systems for refrigerant condensers, evaporators, and electrical control.
  - a) Compressor(s) - Shall be chassis engine-driven and shall not be mounted below the chassis frame rails. Compressor applications must be approved in writing by the chassis engine manufacturer, stating that the installation will not void or reduce the engine manufacturer's warranty or extended service coverage liabilities in any way.
  - b) Condenser(s) - Shall be equipped with copper coils and aluminum or copper fins, except that any chassis manufacturer supplied aluminum-coiled condenser is acceptable for Type A applications. Body skirt-mounted condenser(s) are required on Type C, and D buses.
  - c) Controls - All systems operating controls, including on-off switch(es), blower switch(es) and thermostat control(s) shall be accessible to driver in seated position.

- d) Warranty- Total air conditioning system all parts and labor shall be fully warranted for a minimum of two years with no limitations based on operating hours.

## Bus Body Racking Test

A diagonal (racking) load test shall be performed on Type A, C and D buses to insure adequate shear stiffness and strength of the bus body. This test shall be performed as outlined below.

### **SET-UP – The following procedures shall be performed in preparing the bus body for testing.**

1. The vehicle shall be supported on a rigid surface along the lower edge of the frame or along the body sills in the absence of a frame.
2. The load shall be applied through a force application plate that is flat and rigid. The dimensions of the plate shall be chosen to insure plate edges never make contact with the vehicle skin during testing. A typical width is 18 inches, and a typical length is 20 inches less than the length of the vehicle's roof measured along its longitudinal centerline.
3. Place the force application plate in contact with the edge of the vehicle roof. Orient the plate so that its flat, rigid surface is perpendicular to a diagonal line connecting the most distant points on an interior cross section of the vehicle. The rear edge of the plate shall be positioned approximately 20 inches from the rear edge of the vehicle roof. A temporary stand may be used to support the plate until a force is applied.

**FORCE APPLICATION** - A force equal to one and one half (1-1/2) times the Gross Vehicle Weight shall be applied to the edge of the roof of the vehicle's body structure through the force application plate. This force shall be applied in a two (2) cycle process of loading/unloading.

**TEST CRITERIA** - Each bus body must be certified as complying with the following requirements during both of the loading/unloading cycles.

1. The diagonal movement of the force at any point on the application plate shall not exceed five and one eighth inches (5 1/8").
2. Each emergency exit of the bus shall be capable of full operation as specified in FMVSS 217 during the application of force, at the full application of force and after release of the force.

## Bus Body Side Intrusion Testing

The bus body shall be tested to insure that the design and construction is such that separation of body panels and passenger compartment intrusion does not occur as a result of side impact.

**SIDE CONSTRUCTION - School bus body sides shall be designed and constructed to insure that there will be no separation of a construction joint or lapped panel from a side impact. The body sides shall be constructed to withstand a minimum intrusion force of twenty thousand (20,000) pounds as outlined below.**

1. The test body shall be complete in structure with seats installed on the impact side and consisting of a minimum of seven (7) body sections.
2. The impact test shall be performed on a centerline of the seven (7) body sections.
3. The bus body shall be impacted at a point twenty-four inches (24") plus or minus two inches (+/- 2") above the floor line, with an eight to ten inch (8-10") diameter cylinder, forty-eight inches (48") long, mounted in a horizontal plane.
4. The cylinder shall impact the body side, spanning two (2) roof posts in a body side area, having interior lapped panels.
5. The exerted force shall not exceed the amount required to create eight (8") minimum to ten inches (10") maximum penetration of the body side into the passenger compartment after impact.

**INTERIOR PANEL -** The bus body shall be tested to insure that the design and construction of the interior panels is such that separation of a lapped panel joint does not occur as a result of side impact.

1. The body will be impacted at any point along the roof line on the outside surface.
2. Impact shall occur using a cylinder eight inch (8") in diameter and forty-eight (48") long.
3. Impact shall occur at a thirty (30) to forty-five (45) degree angle at a position one inch (1") to three inches (3") above the top window line.
4. The cylinder shall impact the roof line with forty-eight inches (48") dimension in a vertical plane.
5. The exerted force shall not exceed the amount required to create (8") minimum to ten inches (10") maximum penetration of the body panels into the passenger compartment after impact.

Certification documents shall include test performance; showing the body side, window header, and floor line deformation of the body side, along with the amount of force exerted to achieve the required for penetration.